

ERIC Document Resume		See Instruction Sheet		DATE OF RESUME		DATE RECEIVED	
A. PUBLICATION DATA							
1. ERIC NUMBER E D001393		2. ORIGINATOR CONTROL NO(S). N.A.		3. IDENTIFICATION NO. CR 859		DO NOT WRITE IN SPACE BELOW	
4. AUTHOR(S): Johnson, G. Orville						MICROFILM COPY AVAILABLE YES ☒ NO ☐	
5. TITLE OF DOCUMENT ABSTRACTED: Relationship Between Perception and Learning in the Mentally Retarded						COPYRIGHT GRANTED YES ☐ NO ☒	
						COPYRIGHT RELEASE FILED YES ☐ NO ☐	
6. PUBLICATION TITLE: N.A.						TYPE OF REPORT	
7. EDITOR(S): N.A.				8. PLACE OF ORIGIN ORG. Syracuse University ST. Research Institute CITY Syracuse , STATE New York		PROPOSAL ☐	
9. PUBLISHER OR SOURCE Cooperative Research Project, Office of Education, Dept. of HEW, Wash., D.C.						IN-PROGRESS ☐	
						FINAL ☒	
						FOLLOW-UP ☐	
						OTHER ERIC REFERENCES:	
10. VOL. N.A.	11. PAGES N.A.	12. MO./YR. 1/63	13. TOTAL PP. 103	TELE. EXT. INST/LOC CODE		ERIC SATELLITE CODE	
B. INDEXING DATA							
14. SUBJECT AREA				15. TYPE OF ENDEAVOR experimental research			
16. INDEXING TERMS (0-12)				learning methods			
mentally retarded				perceptual testing			
visual-auditory perception				screening tests			
background effects				diagnostic tests			
17. ABSTRACT (MAX. 250 WORDS)							
The conclusion to be drawn is in support of the evidence against perceptual disorders creating interference in learning. The contention that a perceptual figure ground disturbance necessarily interferes with the learning process is not supported by the evidence. There are indications, however, that background interference seems to affect some children more than others. Two unique features of the present study are the inclusion of an auditory figure-background test for selection purposes, two auditory learning tests, and one visual-auditory learning test.							
ERIC No.							
18. SOURCE OF ABSTRACT							
C. FUNDING DATA							
19. SUPPORTING ORGANIZATION				20. DIVISION OR DEPT.		21. CONTRACT NO.	
				22. TOTAL COST OF PROJECT		PROJECT NO.	
				23. DURATION OR PROJECT		U.S. Department of Health, Education, and Welfare Office of Education	

859

RELATIONSHIP BETWEEN PERCEPTION AND LEARNING
IN THE MENTALLY RETARDED

G. Orville Johnson, Ed. D.
Professor of Special Education
Syracuse University

ED001393

ED001393

September 1, 1960—January 31, 1963

SYRACUSE UNIVERSITY RESEARCH INSTITUTE
Office of Research in
Special Education and Rehabilitation

REPRINTED BY PERMISSION
U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN PRINTED EXACTLY AS RECEIVED FROM THE PERSON
OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT
NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

RELATIONSHIP BETWEEN PERCEPTION AND LEARNING
IN THE MENTALLY RETARDED

G. Orville Johnson, Ed. D.
Project Director
Syracuse University

September 1, 1960 - January 31, 1963

SYRACUSE UNIVERSITY RESEARCH INSTITUTE
Office of Research in Special Education and Rehabilitation

The research reported herein was performed pursuant to
Contract SAE-8989 with the United States
Office of Education, Department of
Health, Education, and Welfare

PREFACE

The behavioral sciences have contributed, over the past half century, some information concerning the mentally retarded that has been of value in planning programs and organizing instruction. Unfortunately, the information is so limited and fragmented that most programs are still being organized and conducted upon casual observation of a limited number of children within a specific setting, philosophically derived objective with little or no regard concerning the psychological characteristics and needs of the children, or information and theories based upon inadequate and biased studies, rather than upon scientific information. From time to time the research emphasis has changed. During one period the emphasis has been in relation to reading and the learning of academic skills. At another time the primary interest has been concerned with follow-up and community adjustment. More recently one notes the high incidence of studies related to learning characteristics and learning theory. Over an extended period of time these latter studies have attempted to determine causes of learning disabilities.

Some of the major work related to the problem of learning disability in the mentally retarded has been concerned with the area of perception - originally as this was related to brain-injury. Basic research dealing with the learning characteristics of children with visual and/or auditory perceptual problems, however, is almost non-existent. Most of it has been primarily concerned with the existence of and ways of identifying the condition. It is anticipated that the present research will contribute materially to the understanding of any relationship of learning and perception that may exist. While the findings may be far from definitive, they should provide information that will be of value in pointing the way for future studies. Only in this way can more appropriate and effective instructional programs be developed.

G.O.J.

ACKNOWLEDGMENTS

The investigator is very appreciative of the assistance he received from the personnel of the Syracuse University Computing Center and the administrators and teachers of the several school systems whose cooperation made the study possible.

The research assistants (Albert Lampe, Richard Iano, Anthony Chiappone, Karen Stotz, and Ronald Hatch) all took a very personal interest in the various aspects of the study, willingly contributed beyond normal demands, and added materially to the design, selection of tasks, as well as performing the more routine job of collecting data. Much of the value of the study and specific outcomes are due to their outstanding contributions.

CONTENTS

	Page
Preface	i
Acknowledgements	ii
List of Tables	v-vi
CHAPTER I. STATEMENT OF THE PROBLEM.....	1
Significance of the Problem	2
Definition of Terms	3
Hypotheses	3
CHAPTER II. REVIEW OF THE LITERATURE.....	5
Re: Relationship Between Perception and Learning.....	5
Learning Abilities of Brain-Injured and Non-Brain-Injured Adults.....	6
Learning Abilities of Brain-Injured and Non-Brain-Injured Children.....	8
Concept Development.....	8
Arithmetic and Reading Achievement.....	10
Learning Abilities.....	13
Bibliography.....	15
CHAPTER III. PROCEDURE.....	16
Screening Devices.....	18
Massachusetts Vision Test.....	18
Audiometric Sweep Test.....	18
Wechsler Intelligence Scale for Children.....	18
Syracuse Visual Figure-Background Test (SVFBT).....	18
Syracuse Auditory Figure-Background Test (SAFBT).....	19
Visual Learning Tasks.....	21
Serial Learning.....	21
Paired Associate Learning.....	22
Discrimination Learning.....	23
Coding Learning.....	24
Concept Formation Learning.....	25
Auditory Learning Tasks.....	27
Serial Learning.....	27
Paired Associate Learning.....	27
Visual-Auditory Learning Task.....	28
Diagnostic Achievement Tests.....	28
CHAPTER IV. RESULTS.....	29
Visual Learning Tasks.....	29
Serial Learning.....	29
Paired Associate Learning.....	33
Coding Learning.....	34
Discrimination Learning.....	35
Concept Formation Learning.....	38
Auditory Learning Tasks.....	39
Serial Learning.....	39
Paired Associate Learning.....	41
Visual-Auditory Learning Task.....	41

CONTENTS (Cont'd.)

Correlations Among Learning Tasks.....	42
Serial Learning.....	42
Paired Associate Learning.....	52
Coding Learning.....	53
Discrimination Learning.....	53
Concept Formation Learning.....	54
Learning Performance of Low(Poor) and High (Good)	
Perception Groups.....	54
Serial Learning.....	55
Paired Associate Learning and Transfer.....	57
Coding Learning and Proactive Inhibition.....	57
Discrimination Learning and Transfer.....	57
Concept Formation Learning and Transfer.....	59
Correlations Among Diagnostic and Achievement Tests.....	59
Developmental Test of Visual Perception (DTVP).....	62
Test of Primary Mental Abilities (PMA).....	62
The Illinois Test of Psycholinguistic Ability (ITPA)....	64
Botel Reading Inventory.....	64
Correlations Among the Learning and Transfer Tasks and the	
Diagnostic Achievement Tests.....	66
Developmental Test of Visual Perception.....	66
Test of Primary Mental Abilities.....	68
The Illinois Test of Psycholinguistic Ability.....	69
Botel Reading Inventory.....	72
Comparison of Learning Task Performance,	
No Background and Background.....	73
 CHAPTER V. SUMMARY AND DISCUSSION.....	76
 References.....	81-83
 Appendices	
A. Serial Learning.....	84
B. Paired Associate Learning.....	85-87
C. Coding Learning.....	88-91
D. Discrimination Learning.....	92
E. Concept Formation Learning.....	93-95
F. Paired Associate Learning (Visual-Auditory).....	96

LIST OF TABLES

	Page
I. Characteristics of the Population Used for the Visual Learning Tasks....	20
II. Characteristics of the Population Used for the Auditory Learning Tasks and the Visual-Auditory Learning Task.....	20
III. Table of t Ratios for the Visual Learning Tasks.....	30
IV. Correlations Among the Diagnostic Tests and Visual Serial Learning, Recognition, Recall, and ERRORS. No Background and Background.....	32
V. Correlations Among the Diagnostic Tests and Visual Paired Associate Learning and Transfer. No Background and Background.....	32
VI. Correlations Among the Diagnostic Tests and Visual Coding Learning and Proactive Inhibition Tasks. No Background and Background.....	36
VII. Correlations Among the Diagnostic Tests and Visual Discrimination Learning (Time), Discrimination Error, Discrimination Transfer Learning (Time), and Discrimination Transfer Error. No Background and Background.....	36
VIII. Correlations Among the Diagnostic Tests and Visual Concept Formation Learning. No Background and Background.....	38
IX. Table of t Ratios For the Auditory Learning Tasks.....	40
X. Correlations Among the Diagnostic Tests and Auditory Serial Learning and Paired Associate Learning. No Background and Background.....	40
XI. Table of t Ratios For the Visual-Auditory Learning Task.....	43
XII. Correlations Among the Diagnostic Tests and Visual-Auditory Paired Associate Learning. No Background and Background.....	43
XIII. Intercorrelations Among Visual Learning Tasks, Including Learning, Transfer, Recognition, Recall, Proactive Inhibition, and Error. No Background and Background.....	44-49
XIV. Intercorrelations Among Visual Learning and Transfer Tasks Only. No Background and Background.....	50-51
XV. Comparisons of Chronological Ages, Mental Ages, Intelligence Quotients, and Combined SVFBT-SAFBT Scores of Low (Poor) and High (Good) Perception Groups.....	55
XVI. Comparisons of Visual Serial Learning Performances of Low (Poor) and High (Good) Perception Groups. No Background and Background.....	56
XVII. Comparisons of Visual Paired Associate Learning and Transfer Performances of Low (Poor) and High (Good) Perception Groups. No Background and Background.....	56

LIST OF TABLES (Cont'd.)

XVIII.	Comparisons of Visual Coding Learning and Proactive Inhibition Performances of Low (Poor) and High (Good) Perception Groups. No Background and Background.....	58
XIX.	Comparisons of Visual Discrimination Learning and Transfer Performances of Low (Poor) and High (Good) Perception Groups. No Background and Background.....	58
XX.	Comparisons of Visual Concept Formation Learning and Transfer Performances of Low (Poor) and High (Good) Perception Groups. No Background and Background.....	60
XXI.	Summary of Mean Learning Task Scores (No Background and Background) and t Ratios for Low (Poor) and High (Good) Perception Sub-Groups....	61
XXII.	Correlations Among the Diagnostic Tests and Developmental Test of Visual Perception.....	63
XXIII.	Correlations Among the Diagnostic Tests and The Test of Primary Mental Abilities.....	63
XXIV.	Correlations Among the Diagnostic Tests and Illinois Test of Psycholinguistic Ability.....	65
XXV.	Correlations Among the Diagnostic Tests and The Botel Reading Inventory.....	65
XXVI.	Correlations Among the Learning and Transfer Tasks (No Background and Background) and the Developmental Test of Visual Perception.....	67
XXVII.	Correlations Among the Learning and Transfer Tasks (No Background and Background) and The Test of Primary Mental Abilities.....	70
XXVIII.	Correlations Among the Learning and Transfer Tasks (No Background and Background) and The Illinois Test of Psycholinguistic Ability....	71
XXIX.	Correlations Among the Learning and Transfer Tasks (No Background and Background) and the Botel Reading Inventory.....	74
XXX.	Mean Learning Task Scores and t Ratios Under Conditions of With No Background Interference and With Background Interference.....	75

CHAPTER I

STATEMENT OF THE PROBLEM

Several studies have been concerned with the relative academic achievement of children who have been classified as exogenous (retardation due to brain injury) and endogenous (retardation due to causes other than brain injury). The largest number of these studies have been of a psychological nature and emphasized such problems as difficulty of testing, comparative results of different tests administered to groups of children, and comparisons of the perceptual abilities of exogenous, endogenous, and normal children. Some attempts have been made to assess conceptual processes, emotional stability, and to make a precise description of various physical and behavioral variables.

The ability to deal with perceptual phenomena is assumed to be basic to intellectual (as well as other aspects of) behavior. Considerable effort has been expended in the assessment of correlates of perceptual performance. One area of this body of research has encompassed the intellectual behavior of individuals classified as brain-injured. Two aspects of this problem may be identified.

First, investigators have sought to determine whether brain-injured subjects as a group perform less adequately on perceptual tasks than do non-brain-injured subjects. What appears to be rather conclusive evidence regarding the inadequacy of performance of the brain-injured group has been presented. However, the observation that there is often an overlap in the performance of the two groups, difficulties in definitive diagnosis of exogeny and endogeny, and biases occasionally present in selection of subjects suggests that more research is needed in this area.

Second, attempts have been made to observe whether individuals who are brain-injured (and thus as a group can be expected to show a greater incidence

-2-

of perceptual pathology) show less adequate performance on psychometric and achievement tests than do non-brain-injured subjects as a group.

The present study is an outgrowth of earlier ones on this latter issue specifically concerning achievement or learning. That is, an inquiry will be made concerning the relationship between visual and/or auditory perceptual efficiency (largely as defined and used by some of the early workers in the field such as Alfred A. Strauss) and the mastery of certain processes of learning where the stimulus is presented visually, auditorily, and visually-auditorily.

SIGNIFICANCE OF THE PROBLEM

Basic laws of learning have been fairly well established and accepted during the past three decades. As a result, methods of instruction for normal children have been changing during this period of time. That the educator recognizes the importance of not only the laws of learning but also the influence of perception in school learning is evidenced by the inclusion of sections dealing with assessment of perceptual characteristics and methods of developing perceptual efficiency in the recognized texts concerned with academic methodology and techniques for the mentally retarded. Most of this educational material, however, is based on a priori consideration. By the definitions of perception and of academic learning little question can be raised concerning the logic involved.

In addition, there has been some investigation of the role of perception in the academic learning of normal individuals. The results of this research tend to support the generalization that perceptual efficiency is one of the foundations of academic adequacy. The data is pertinent to the influence of perception on learning and has become increasingly important during the past decade in the light of studies with non-motorily handicapped, brain-injured children and with cerebral palsied children. While much has been learned con-

cerning the measurement of visual perception particularly, little or no related work has been done with these children in reference to their learning abilities or disabilities.

With this background, it was a logical step for the special educator to inquire about the academic adequacy of a group of exceptional children in whom perceptual pathology had been observed--the brain-injured and cerebral palsied. In recent years there have been several investigations of this problem. The obtained data pertained primarily to the academic achievement levels accomplished by the children studied rather than to their learning characteristics per se (i.e., to the effect of perceptual disabilities on their methods of acquisition of intellectual material and the rapidity with which they learned).

Specifically, this study will deal with the relationships found among visual and auditory perceptual ability, chronological age, mental age, intelligence quotient, and specific learning tasks (visual, auditory, and visual-auditory).

DEFINITION OF TERMS

For the purpose of this study mentally retarded children are those children who have intelligence quotients within the range of 60 to 84 as measured by the Full Scale Score on the Wechsler Intelligence Scale for Children. The children had chronological ages between 7 and 13 years.

HYPOTHESES

1. There is no significant correlation between visual and auditory perceptual ability as measured by the tests employed and learning performance (visual Serial Learning, Paired Associate Learning, Discrimination Learning, Coding Learning, Proactive Inhibition, Concept Learning, and Transfer; auditory Serial Learning and Paired Associate Learning; and visual-auditory Paired Associate Learning) in a situation containing a minimum of visual and auditory background interference.

2. There is no significant correlation between the visual and auditory perceptual ability as measured by the tests employed and learning performance (visual Serial Learning, Paired Associate Learning, Discrimination Learning, Coding Learning, Proactive Inhibition, Concept Learning, and Transfer; auditory Serial Learning and Paired Associate Learning; and visual-auditory Paired Associate Learning) in a situation of controlled extraneous auditory and visual background interference.

3. There are no significant differences between the results obtained on the learning tasks in a situation containing a minimum of visual and auditory background interference and the results obtained on the learning tasks in a situation of controlled visual and auditory background interference.

CHAPTER II

REVIEW OF THE LITERATURE

RE: RELATIONSHIP BETWEEN PERCEPTION AND LEARNING

Numerous studies have been conducted with non-motor handicapped (exogenous) children and cerebral palsied children to demonstrate the presence of perceptual disturbances. Studies designed to measure learning characteristics of children diagnosed primarily as perceptually disordered, however, are exceedingly rare. Practically all of the studies completed that have involved perceptual disorders (and this is particularly true of the early ones) have used some measure of brain-injury as a criteria. Originally the concept of perceptual disturbance and exogeny (brain-injury) were almost considered to be synonymous. While it was recognized that not all exogenous children showed severe perceptual disturbance and some apparent endogenous children were not free from perceptual disturbance, these facts were largely ignored. Only in recent years has it been recognized and accepted that perceptual disturbance may exist with no diagnosable brain pathology existent.

In a recent comprehensive review of studies in this area, Gallagher (5) concluded that there is "...a true difference between brain-injured children and non-brain-injured children as far as perceptual discrimination is concerned" (p. 12) He also points out that there is ample "...evidence to support the notion that brain-injured children as a group have trouble integrating perceptual stimuli or shifting effectively from one stimulus to another." (p. 15) Because of this relationship, research involving brain-injured children can be used in this review.

It was assumed by some of the persons who were responsible for the early studies (particularly Strauss and Lehtinen) that these perceptual disturbances interfere with the child's ability to benefit from instruction provided in the

ordinary classroom. Special educational facilities, therefore, must be provided for these children.

Strauss and Lehtinen (12), who have advocated a special program when discussing the teaching of arithmetic to brain-injured children, state the rationale clearly:

"The brain injured organism lacks the ability possessed by the normal child to discover spontaneously the significant relationships of the number system. Accepting the thesis that a perceptual scheme of visual spatial organization is the basis of calculation, it is reasonable to anticipate that the organism whose ability to construct such a perceptual scheme has been disturbed will be hindered in any activities which require its use." (p. 148)

Simply stated, they have assumed that since brain-injured children possess some perceptual disturbances they will be unable to benefit from regular educational instruction and will require a unique teaching method.

Research related to the present study has been organized into various related areas in order that the amount and consistency of the findings in each of these areas might be more easily appraised. Only those studies comparing the learning abilities of brain-injured children and/or adults (with or without intellectual deficit) with organically sound children or adults (with or without intellectual deficit) will be included in the present review.

LEARNING ABILITIES OF BRAIN-INJURED AND NON-BRAIN-INJURED ADULTS

Robertson (11) investigated paired associate learning and rote learning abilities of brain-injured and non-brain-injured neuropsychiatric patients. He found that when vocabulary and age were allowed for, the brain-injured group was significantly less efficient than the non-brain-injured group on paired associate learning, but that the position of the groups on rote learning was less clear.

Doehring and Reitan (4) administered the Halstead Category Test to matched groups of brain-injured patients with left hemisphere lesions, brain-injured

patients with right hemisphere lesions, and non-brain-injured patients (control group). The groups were comparable on both age and education. The mean age for all groups was approximately 39 years, the mean educational level approximately 11 years.

Both of the brain-injured groups were found to be significantly impaired in concept attainment as compared with the non-brain-injured group, but there were no significant differences between the two brain-injured groups on any of the measured aspects of concept attainment. The control group also made significantly fewer errors than did the brain-injured groups. All three groups, however, were comparable with respect to the pattern of errors made on the subtests of the Category Test.

Matthews and Reitan (7) also utilized the Halstead Category Test in comparing the learning abilities of patients with recent cerebral damage with (non-brain-injured) institutionalized retardates. Each retardate was matched within two points on Full Scale Wechsler-Bellevue Intelligence Quotient Scores with a brain-damaged subject. The results of the Category Test comparisons indicated that the (non-brain-injured) retardates showed significantly poorer performance on this measure of concept-formation ability than the fairly recently brain-injured patients. Further comparisons demonstrated that the retardates showed greater impairment in abstraction ability, but at the same time they showed significantly more absolute and proportional improvement than did the brain-injured patients when the abstraction principle needed for solution of the problem remained constant.

In the area of learning abilities of brain-injured and non-brain-injured adults relatively little research has been conducted. The few studies that have been made in this area have utilized inadequate control groups and the results are both poorly reported and often contradictory in nature. A great deal of further research is necessary before any generalizations can be made.

LEARNING ABILITIES OF BRAIN-INJURED AND NON-BRAIN INJURED CHILDREN

CONCEPT DEVELOPMENT

Strauss and Werner (13) compared a group of familial retarded children (mean M.A. 9-0, mean I.Q. 73) with a group of brain-injured retarded children (mean M.A. 8-11, mean I.Q. 70) on three tasks designed to measure or require conceptual ability. In the first task, 56 common objects were placed before each child and he was required to group those objects which were related in some manner. A minimum of 10 groupings were required, but the children were allowed to make as many additional groupings as they desired.

The brain-injured children used more objects and made many more groupings than did the familial group. The brain-injured children had 30 "infrequent" combinations in contrast to the familial children's 11.

In the second phase of the experiment, the children were required to match a key object with one of three other objects in a meaningful association. The familial group made 29 such associations while the brain-injured group made 52.

In the final task, the children were required to place various objects in front of two pictures, a drowning boy and a building on fire. The brain-injured children used more human figures and approximately twice as many objects as the familial children. The authors felt that the groupings made by the brain-injured children were based on unusual or insignificant details of the objects. Any statistical analyses that may have been used were not reported.

Halpin and Patterson (6) compared a group of 15 brain-injured retarded children with a group of 15 familial mentally retarded on the Goldstein-Scheerer Color Form Sorting Test. The groups were matched on M.A., C.A., and I.Q. The Color Form Sorting Test measures a child's ability to identify the sorting principle involved (form or color) and the ability to shift from one principle to another. No significant differences were found between the groups on either

sorting or shifting but the brain-injured group attempted fewer pattern formations than did the familial group. These results do not support the findings of Werner and Strauss cited above.

In a similar experiment, McMurray (8) compared 15 brain-injured mentally retarded children with 15 familial mentally retarded children on the Wisconsin Card Sorting Test. This test also measures children's ability to correctly identify the sorting principle involved (form, color, or number) and their ability to shift set from one sorting principle to another. The results indicated that brain-injured children took longer to identify the sorting principle involved and that they had more difficulty in switching their set than did the familial children.

Werner and Carrison (14) compared a group of 18 brain-injured mentally retarded boys with a group of 18 familial mentally retarded boys, matched on M.A. and I.Q., on their ability to distinguish living from non-living objects. A number of common objects were placed in front of the children and they were asked questions concerning the animistic nature of inanimate objects, natural events, animals, and plants. The brain-injured group ascribed life to approximately twice as many inanimate objects as the familial group. The brain-injured children also showed a slight tendency to see natural phenomenon as living and gave more unique answers.

In the second part of the experiment the children were asked questions about whether non-living objects had feelings or consciousness. The brain-injured children more often attributed consciousness to inanimate objects and natural phenomena than did the familial children.

The authors concluded that the higher incidence of animistic thinking found in brain-injured children could not be attributed to retardation in verbal concepts, but rather that it was due to their perseveration, their peculiar approach to stimuli, and their inability to perceptually discriminate.

Studies dealing with the conceptual abilities do not provide the reader with clear-cut, definitive evidence regarding either the degree or the nature of the influence of brain-injury and/or perceptual disability in this area of behavior. There is some indication that brain-injured children have difficulty in concept formation only because they are unable to attend to the relevant task of the moment.

ARITHMETIC AND READING ACHIEVEMENT

The rationale behind Strauss's and Lehtinen's hypothesis that brain-injured children would do more poorly on arithmetic concepts than would non-brain-injured children was cited earlier. It is significant to note, however, that their conclusions were based entirely on case history material. The following review of the literature will show that there is little research evidence to substantiate Strauss's and Lehtinen's hypothesis.

Bensberg (1) administered the American School Achievement Test to 20 brain-injured, institutionalized females and 20 familial, institutionalized females matched on M.A. and C.A. He found that there were no significant differences between the groups on arithmetic skills. In the same study, he also compared 18 brain-injured males with 18 familial males on the same test and found no significant differences.

Capobianco (2) studied the arithmetic abilities of 35 endogenous and 29 exogenous mentally retarded boys matched on I.Q., M.A., and C.A. The boys were drawn from the male population of a residential school where no special program for the brain-injured had been provided. The M.A. range of the subjects was 6-2 to 11-8, and the I.Q. range from 41 to 78. The following arithmetic tests were administered to both groups: the Compass Survey Test (computation); the Stanford Achievement Primary Arithmetic Test (reasoning); the Bushwell-John Diagnostic Chart (habits of computation); and the Hannun Arithmetic Test

(general aspects of arithmetic achievement). Qualitative tests of rigidity, reversals, and concept of zero were adapted from Hannun test items.

The analyses of the quantitative tests showed no significant differences between the groups on computation, arithmetic reasoning, and the general areas of arithmetic achievement. Qualitative analyses showed no significant differences between the groups on rigidity, reversals, and concept of zero. In addition, the endogenous group was found to be functioning slightly below its mental age level on all three quantitative tests, while the exogenous group performed more closely to its mental age level, working up to its mental age in arithmetic reasoning. The author concludes that:

"The absence of statistically significant differences between the endogenous and exogenous groups in this investigation strongly suggests that the exogenous subjects need not be confined to unique teaching methods in order to achieve up to their mental age in arithmetic. There is no reason to assume that the teaching methods at the state school (used in this investigation) catered to the exogenous pupil, yet the exogenous group consistently worked more closely to capacity than did the endogenous subjects." (p. 135)

Gallagher (5), in one phase of a comprehensive study, matched groups of 24 brain-injured mentally retarded children and 24 familial mentally retarded children and compared their performance on a measure of quantitative ability. He found no significant differences between the groups on any measures of quantitative concepts. Commenting on his findings, Gallagher states that:

"There seems to be little reason for making any special provisions for teaching these (quantitative) concepts to groups of brain-injured children. Although perceptual problems were supposed to interfere with the development of quantitative conceptualization, this does not appear to have been the case. Some children in both groups did show a tendency to reverse numbers and geometric figures but this seemed to be an isolated difficulty which did not negatively influence the actual learning of grouping principles, number combinations, etc. Except in certain unique and individual cases, the role perceptual difficulties play in the development of quantitative concepts seems greatly over-rated." (p. 66)

Investigating some aspects of the reading process, Miller (9) compared 29 brain-injured mentally retarded children with 29 familial mentally retarded

children matched on M.A. (7 to 12 years), C.A. (not over 22 years) and I.Q. (50 to 85). In addition, the brain-injured children showed visual perceptual disturbance on the Syracuse Visual Figure-Background Test while the non-brain-injured children did not. He found that the brain-injured mentally retarded children did not differ significantly from familial retarded children in silent reading achievement, oral reading achievement, auditory techniques, and visual perceptual techniques. An analysis of the pattern of reading errors showed that the brain-injured group had significantly more repetition of words than the familial group, while the brain-injured group had significantly fewer refusals and words aided than the familial group.

Neely (10) did a correlational study with 52 cerebral palsied children between the ages of 10 and 16 years and with an intelligence quotient range from 80 through 135. Each child was administered five tests of visual perception (three unrelated to school instructional experiences and two containing hidden and imbedded words and thus directly related to a school learned skill - reading), an achievement test, and an intelligence test. The investigator found no significant relationship between intelligence or school achievement and performance on tasks of visual perception unrelated to school experience. He did find, however, a significant relationship existed between academic achievement and visual perception tasks related to school experiences. He concluded that:

"There is no evidence...to indicate that the educational achievement present was directly related to difficulty in differentiating figure from ground. Except for those figure-ground tasks embodying achievement materials (words) there appeared to be no significant relationship between performance in these types of tasks and achievement. It was apparent that the brain-damaged children comprising the present sample had been enabled to organize perceptual materials with which they were familiar despite the imbeddedness or mutilation of the presented stimuli." (pp. 76-77).

Research concerning the arithmetic and reading abilities of brain-injured children, brain-injured mentally retarded children, and familial retarded children demonstrates unequivocally that there are no significant differences between these groups on these abilities. Strauss's and Lehtinen's hypothesis that brain-injured children would encounter special difficulties in arithmetic requiring special educational procedures is not supported by the research evidence. Not only have no consistent differences been found, but in the studies by Bensberg, Capobianco, and Miller the teachers had been unaware the children were brain-injured and no special instructional techniques had been used. This was also true for the cerebral palsied children in Neely's study, where no special techniques had been used. He also indicated no measurable relationship between academic achievement and degree of visual perceptual involvement.

LEARNING ABILITIES

In a study referred to previously, Gallagher (5) also investigated learning aptitudes of brain-injured mentally retarded and familial mentally retarded children. He found no significant differences between the groups on memory, learning through experience, and response to the environment surrounding the learning situation.

"The fact that the brain-injured group seemed to learn almost as effectively as the familial children again suggests that perhaps too much emphasis has been placed on the differences between these diagnostic categories and not enough attention directed toward their similarities." (p. 66)

In a recent overview of research in learning, motivation, and perception, Zigler (15), points out that:

"There have been several recent investigations re-evaluating behavioral differences in learning and perception between familial and organic retardates. The results have revealed smaller differences than those previously reported. This work suggests that the nature of intellectual deficit does not differ between the two types of individuals to the degree previously believed, and that differences in performance previously found may be related to differences in motivational structure. Recent studies have shown

that familials tend to be drawn from a narrow portion of the general population, while organics are drawn from a broader segment of the general population. Thus, class differences previously found in general learning and motivation undoubtedly operate with retarded children. The literature on social class provides insight into types of controls which are appropriate in studying different types of retarded individuals." (p. 457)

Only one study was found comparing the learning abilities of brain-injured and familial retarded children. Although this study showed no differences between the two groups, special educational methods continue to be advocated for brain-injured children. The validity of such methods are subject to question since they have received no research support to date.

BIBLIOGRAPHY

1. Bensberg, G. J., "The relationship of academic achievement of mental defectives to mental age, sex, institutionalization, and etiology," Amer. J. Ment. Def., 1953, 58, 327-330.
2. Capobianco, R. J., "Quantitative and qualitative analyses of endogenous and exogenous boys on arithmetic achievement," Monogr. Soc. Res. Child Develpm., 1956, 19, 101-141.
3. Cruickshank, W. M., Bentzen, F. A., Ratzeburg, F. H., and Tannhauser, Mirian T. A Teaching Method for Brain-Injured and Hyperactive Children. Syracuse: Syracuse University Press. 1961.
4. Doehring, G., and Reitan, R. M., "Concept attainment of human adults with lateralized cerebral lesions," Perceptual and Motor Skills, 1962, 14, 27-33.
5. Gallagher, J. J., "A comparison of brain-injured and non-brain-injured mentally retarded children on several psychological variables," Monogr. Soc. Res. Child Develpm., 1957, 22, 1-79.
6. Halpin, Virginia, and Patterson, Ruth., "The performance of brain-injured children on the Goldstein-Scheerer tests," Amer. J. Ment. Def., 1954, 59, 91-99.
7. Matthews, Charles G., and Reitan, Ralph M. "Comparisons of abstraction ability in retardates and in patients with cerebral lesions," Perceptual and Motor Skills, 1961, 13, 327-333.
8. McMurray, J. G., "Rigidity in conceptual thinking in exogenous and endogenous mentally retarded children," J. Consult. Psychol., 1954, 18, 366-370.
9. Miller, D. Y., Quantitative and Qualitative Analyses of Exogenous and Endogenous Children in Some Reading Processes, Unpublished doctor's dissertation, Syracuse University, 1958.
10. Neely, James H., A Study of the Relationship of Figure Background Difficulty and School Achievement in Cerebral Palsied Children, Unpublished doctoral dissertation, Syracuse University, 1958, 82 pp.
11. Robertson, J. P. S., "Age, vocabulary, anxiety, and brain damage as factors in verbal learning," J. Consult. Psychol., 1957, 21, 179-182.
12. Strauss, Alfred A., and Lehtinen, Laura E., Psychopathology and Education of the Brain-Injured Child, New York: Grune and Stratton, 1947.
13. Strauss, Alfred A., and Werner, H., "Disorders of conceptual thinking in the brain-injured child," J. Nerv. Ment. Dis., 1942, 96, 153-172.
14. Werner, H., and Carrison, Doris, "Animistic thinking in brain-injured mentally retarded children," J. Abnorm. Soc. Psychol., 1944, 39.
15. Zigler, E., "An overview of research in learning, motivation, and perception," Exceptional Children, 1962, 28, 455-458.

CHAPTER III

PROCEDURE

A population of mentally retarded children from 7 through 12 years of age with intelligence quotients between 60 and 84 were selected from the school systems within a 60 mile radius of Syracuse, New York. The intelligence quotients were determined by the use of the Full Scale Score on the WISC. If the WISC score on a child, as determined by a local school psychologist, was more than one year old, a new examination was administered by qualified psychologists on the project staff. The subjects were also screened with hearing and vision tests to eliminate those children with auditory and/or visual impairments that might be interpreted as being perceptual disabilities.

A sample of 49 children meeting the above criteria were used as subjects for the learning tasks that were primarily visual in nature. Twenty-eight of the original group of 49 children were used as the subjects in the learning tasks that were primarily auditory in nature as well as the one visual-auditory learning task.

The groups were divided upon a random selection basis into two equal subgroups (25 subjects in one and 24 subjects in the other for the visual learning tasks and 14 in each of the auditory learning tasks and the visual-auditory learning task). One set of the groups was presented, initially, the battery of learning tasks with a minimum amount of extraneous auditory and visual background stimuli. At a later date (approximately 6 to 8 weeks) they were administered equated learning tasks of the same nature but with controlled, high-level visual and auditory interference. The other set of groups had the process reversed. They were initially presented the original battery of learning tasks but with controlled, high-level visual and auditory background interference. This was followed at a later date (approximately 6 to 8 weeks) with a presentation of the equated learning tasks of the same nature but with a minimum amount

of extraneous auditory and visual background interference. The purpose of grouping the subjects and offering the learning tasks alternately under the two learning conditions was to negate the possibility of any differences occurring due to transfer. In this way, any differences that might appear could only be attributed to the presence or absence of background interference.

The visual learning tasks included the following: serial learning, paired associate learning and transfer, concept formation, discrimination learning and transfer, and coding and proactive inhibition. The auditory learning tasks included serial learning and paired associate learning. The visual-auditory learning task consisted of paired associate learning.

In addition to the learning tasks, all the children were administered the following tests: Primary Mental Abilities Test, Frostig Test of Visual Perception, Syracuse Visual Figure-Background Test, Syracuse Auditory Figure-Background Test, Botel Reading Inventory, and Illinois Test of Psycholinguistic Ability.

A total of 106 children were screened. With the exception of one school district, all of the children were enrolled in special classes for the educable mentally handicapped. Of the children screened, 5 failed the hearing test, 18 failed the vision test, 2 were under the minimum age established for the study and 2 were within one month of being 13 years of age at the beginning of the study and would have become overage during the collection of data, 5 were found to have I.Q.'s under the established minimum of 60, and 20 had I.Q.'s that were 85 or over. Fifty-four children thus remained. Five were dropped during the course of the study, 1 moved away, 2 were chronically absent from school. 1 was so uncooperative that his test results were highly questionable, and 1 was excluded because of an error in test administration which invalidated the results. This left a sample of 49 children for subjects.

The following is a detailed description of the instruments used in the study.

SCREENING DEVICES

MASSACHUSETTS VISION TEST

The instructions for the test as outlined in the test manual were used.¹ A child was said to fail the test and was excluded from the study if visual acuity for either eye was less than 20/30.

AUDIOMETRIC SWEEP TEST

This test consisted of testing the children with a pure tone audiometer at 250, 500, 1000, 2000, 4000, and 8000 cy./sec. at the 15 db. level. Only when a child was able to hear at every level in both ears at the amplification indicated was he included in the study.

WECHSLER INTELLIGENCE SCALE FOR CHILDREN

WISC's were administered to those children who had not previously had the test and those whose previous test was more than one year ago.

SYRACUSE VISUAL FIGURE-BACKGROUND TEST (SVFBT)

The Syracuse Visual Figure-Background Test employed in this study is the same as that used by Cruickshank, Bice, and Wallen.² It consists of a series of pictures which are briefly flashed on a screen by means of a projector, the exposure time being controlled. The pictures consist of common, everyday objects which are imbedded in a structured background. The subject is required, after each exposure, to indicate what he perceived. The test is scored on the principle of the child's seeing the foreground object only as being the most correct to his seeing just the background as being the most incorrect.

1. AO School Vision Screening Test (Massachusetts Vision Test), American Optical Instrument Division, Manual (A), 1955.

2. William M. Cruickshank, Harry V. Bice, and Norman E. Wallen, Perception and Cerebral Palsy (Syracuse: Syracuse University Press, 1957) 37-46.

SYRACUSE AUDITORY FIGURE-BACKGROUND TEST (SAFBT)

This test was developed for the present study and a separate paper will be written by its creators in which the complete rationale of the test and its validity will be discussed. For the purpose of this study it is sufficient to merely comment that this test is set up following the same principle as the SVFBT, that is, an auditory figure and an auditory background. In the case of the SAFBT, the figure is a common one syllable word which is spoken in a background of noise. The scoring is similar to that of the visual test in that hearing the word, or rather recognizing the word being said amid the noise is considered evidence of better auditory perception than hearing or being aware only of the noise.

Table I is a summary of the characteristics of the subjects used for the visual learning tasks. Their average age was 126.63 months with a range from 87 to 155 months. The average mental age was 92.42 months with a range from 56 to 121 months. The average I.Q. was 72.99 with a range from 61 to 84. Each subject's hearing and vision were within the average or normal range. The average number of background responses given to the Syracuse Visual Figure-Background Test was 8.36 with a range of 4 to 13 out of a possible 16. The average number of background responses given to the Syracuse Auditory Figure-Background Test was 11.77 with a range of 1 to 16 out of a possible 20. The reason for this was that the auditory and visual-auditory learning tasks were given at a later date and the ages were recomputed for the date these tests were administered. On the other factors, I.Q., SVFBT, and SAFBT they were quite similar to the total group of 49 subjects.

TABLE I
CHARACTERISTICS OF THE POPULATION USED FOR THE VISUAL LEARNING TASKS

N = 49		
Mean C.A. = 126.63 months	S.D. = 18.17	Range = 87 - 155
Mean M.A. = 92.42 months	S.D. = 15.8	Range = 56 - 121
Mean I.Q. = 72.99	S.D. = 6.18	Range = 61 - 84
Mean SVFBT = 8.36		Range = 4 - 13
Mean SAFBT = 11.77		Range = 1 - 16

Table II contains a summary of the characteristics of the population used for the auditory learning tasks and the visual-auditory learning task. It will be noted that these subjects were approximately 18 months older chronologically and 13 months older mentally than the population used for the visual learning tasks.

TABLE II
CHARACTERISTICS OF THE POPULATION USED FOR THE
AUDITORY LEARNING TASKS AND THE VISUAL-AUDITORY LEARNING TASK

N = 28		
Mean C.A. = 144.21 months		Range = 108 - 177
Mean M.A. = 105.29 months		Range = 67 - 139
Mean I.Q. = 72.93		Range = 62 - 84
Mean SVFBT = 8.54		Range = 4 - 13
Mean SAFBT = 11.82		Range = 1 - 16

VISUAL LEARNING TASKS

SERIAL LEARNING

A memory test consisting of five nonsense syllables was administered to each subject, Appendix A. Before the learning trials were started, the children were taught to pronounce each syllable on sight as it was presented on a 3 x 5 inch card. Each card was shown to the child and he was told how to pronounce the syllable. The child was next requested to read the syllables as they were presented to him. The order of presentation was changed each time. When the child could read all the syllables correctly two times in a row, he was presented the learning task.

The syllables were given on a memory drum with a one second exposure for each syllable. The anticipation method was used. The subject pronounced the first syllable when he saw a cue consisting of three stars, pronounced the second when he saw the first syllable and so forth through the five syllables. The series was repeated until the subject was able to say the five syllables in serial order correctly two successive times. The number of trials until success was achieved was recorded as the Learning Score.

One week later the subjects were given a sheet of paper on which were printed 72 nonsense syllables within which the five previously learned syllables were to be found. The children were asked to underline the syllables they had learned the previous week. The number underlined correctly was tabulated and recorded as the Recognition Score. The number incorrectly included were recorded as the Error Score. Next the five syllables were presented again and the number of correct responses on the first trial was recorded as the Recall Score.

The group receiving the task with background interference received the same syllables and instructions but during the entire test period a taped recording was played on which was a recording made in an actual classroom of

typical background noises. The syllables on the drum were presented with a background consisting of straight and curved lines. The sheet of paper on which the syllables were to be found among the 72 to determine the Recognition and Error Scores also had a background on it and the tape was played while the children worked.

After six to eight weeks had passed, following the end of the testing, the conditions under which the groups learned were reversed and the equated task was presented as before using a new set of nonsense syllables.

PAIRED ASSOCIATE LEARNING

The learning series of the Paired Associate task involved learning to associate three pairs of nonsense syllables by means of the anticipation method, Appendix B. The transfer series used the same method of response with syllables which were identical to those in the learning series but with modified stimulus syllables (the middle vowel was changed).

The syllables were presented on a memory drum calibrated so that the stimulus syllable appeared alone for two seconds and then the stimulus-response combination appeared together for 2 seconds. Four different arrangements of the syllables pairs were contained on the drum in order to eliminate serial learning.

Once again the children were taught to pronounce each response syllable on sight before the learning trials were started. When the child could read all the response syllables correctly two times in a row, he was introduced to the learning task itself. This involved learning the three paired associates by the anticipation method; e.g., the first syllable appeared alone for 2 seconds, and then the stimulus and response syllables appeared together for 2 seconds; then the second stimulus syllable was presented for 2 seconds and so on throughout the list. One trial consisted of the presentation of one list of three paired associates. The response measure was the number of correct anticipations.

The number of correct anticipations, the number of incorrect anticipations, and the number of omissions were recorded as the trial was in progress. This procedure was continued for 36 trials with a 30 to 45 second rest period between each trial.

Following the learning series, the children were given a 5 minute rest period before the start of the transfer series. In the transfer series the procedure of the learning series was repeated with the material of the transfer series.

The same procedure was used with background noise and visual background material on the memory drum as was done in the Serial Learning task. The specific nonsense syllables used when the groups were switched were also changed.

DISCRIMINATION LEARNING

The learning series consisted of sorting 32 cards bearing four designs which were assumed to be novel and meaningless to the subjects into four boxes bearing label cards corresponding to the four basic designs, Appendix C. The transfer series required sorting 32 cards of the transfer condition into boxes labeled with cards on which appeared the transfer designs. The position of the boxes in the learning series was maintained rigidly in the transfer series. In addition, each transfer label card was put on the box occupied by its learning counterpart.

The four designs of the learning series and the transfer series were the same as those used by Johnson and Blake in their study of learning performance of retarded and normal children.³ The cards were printed in black ink and a separate set of background cards were made on which was printed blue and red lines in a cross-hatch pattern over the figure. The cards were the size of ordinary playing cards and were laminated to keep them clean.

3. G. Orville Johnson and Kathryn A. Blake, Learning Performance of Retarded and Normal Children, (Syracuse: Syracuse University Press, 1960), 71-73.

The subject was introduced to the learning series by a demonstration with four cards showing how they were to be put in the correct boxes. Then the child was given eight practice cards to sort into the correct boxes. When he had done this correctly, he was shown the stop watch and told that his performance would be timed. He was then given the 32 cards and told to sort them as rapidly as possible. In addition he was instructed to try not to make errors, but that if he did so, not to attempt to correct them even though they would be counted.

A trial consisted of ~~sorting all~~ 32 cards. The response measure was the time required to sort all the cards. Time was taken to the nearest .1 of a second from the time that the first card reached the box until the last one was placed. Between trials, the subject was given a 3 minute rest period. During this interval, the time was noted and the cards were removed from the box and the errors noted. The cards were shuffled carefully and inspected to make sure that no two cards bearing the same design were adjoining. The subjects were administered five learning trials. They were then given a five minute rest period before the start of the transfer series.

In the transfer series, the procedure of the learning series was repeated using the material for the transfer series. At the beginning of each trial the subjects were reminded that time was an important factor and they were urged to sort the cards as rapidly as possible. There were six trials in this series.

CODING LEARNING

The coding from the WISC was put on 8 x 11 inch sheets of paper and the number correct and the Error Score for the two minute periods were recorded, Appendix D. Immediately following the first presentation, the second form of the test was presented. The same symbols were used, but this time they were used to represent different numbers. After two minutes, the number of correct and the number of incorrect responses were recorded. The second form was used to measure pro-active inhibition.

For the background presentation, the same forms were used but lines were drawn across them and the background taped noise was used.

CONCEPT FORMATION LEARNING

The Concept Formation task was adapted from the work done by Long and Welch.⁴ Three copies of 18 geometric figures were drawn on 3-inch oak-tag squares, Appendix E. These, in turn, were pasted on pieces of one-quarter inch plywood squares of the same size. A wooden box was constructed which consisted of a board with six three and a quarter inch square depressions set two by two (three rows) and a single square at the bottom. Beside each row and beside the single square at the bottom was a light bulb which was controlled by a switch. In order for the child to make a correct response in the learning series and the transfer series, he had to discover a relationship among several stimuli - the geometric form, its position, and the position of the lights on and off.

Discovery of the relationship requires observation of the constellation of block positions and lights on and off; for instance, when A and B are together the light is on; when B and C are together the light is not on; when A and C are together the light is on. The test involves designating which one of the three extra blocks, when placed in the empty space, will make the light go on (A, B or C). The correct response is block A because it is located in both of the rows in which the lights are on and is not in the row in which the light is off. On the other hand, blocks B and C although appearing one time each when the light goes on, also are located in the row in which the light is not on. Thus, the basic principle underlying the correct solution of all the problems is that the causal object is always the one which is common to the two situations in which the light is on, and not in the situation in which the light is off.

4. L. Long and L. Welch, "Influence of Levels of Abstractness on Reasoning Ability," J. Psych., 13: 41-59, 1942.

A number of combinations of block positions and lights on and off was obtained by varying the geometric form designated as causal, the position of the causal form in both rows and columns, and the sequence of the three extra test blocks from which the selection was made.

In the learning series as each pair of blocks was placed on the box the subject was asked to look at the forms and to tell whether the light was on or off. His attention was called to the single remaining space, the three remaining blocks, and the light which was off. Then, he was instructed to look at the blocks in the rows in which the lights were on and to look at the blocks in the row in which the light was off, to decide which geometric form was causal, to select it from the three extras and to place it in the empty space in order to make that light go on. If the subject's first selection was incorrect, the test light was not turned on and he was given a second choice. If the second choice was incorrect, he was given a third choice. The third choice was correct by elimination. Whenever the correct choice was made, the test light was turned on and the answer was designated as correct. The subject was asked to look at the forms in the rows and to tell why he chose the one he did to make the last light go on. Although his reason was designated right or wrong on the score sheet, no comment was made to the child regarding its adequacy. The response measures recorded were whether the choice was correct or incorrect and whether the principle was correct.

This procedure was repeated in subsequent trials varying the arrangements of the six forms and the lights on and off. The subject was administered 15 trials. If, in this time, he had not made the correct selection on the first choice five consecutive trials and correctly stated the principle, he was given a hint. The hint consisted of instructing him to point to the form which appeared in both rows in which the light was on but did not appear in the row in which the light was off. Then, he was given five more trials and instructed to

state the principle as described above. Following the learning series the children were allowed a 5 minute rest period.

In the transfer series the same procedure was used with three exceptions. First, the forms were different. Second, the subjects were not instructed to verbalize the principle. Third, while the principle remained the same, the combinations of block positions and lights on and off differed from those employed in the learning series.

AUDITORY LEARNING TASKS

SERIAL LEARNING

This test consisted of three nonsense syllables set in serial order on a magnetic recording tape so that they were presented auditorily at regular intervals in the same manner that the visual ones had been presented on the memory drum. A pure tone was utilized as an auditory cue preceding the presentation of the series indicating the subject should respond with the first syllable, the anticipation method being used. The subject was then to respond with the second syllable when he heard the first, and so forth. The series was repeated until the subject was able to say the three syllables in serial order correctly two successive times. The number of trials required was recorded as the Learning Score.

The background condition consisted of having the syllables presented with accompanying background noise.

PAIRED ASSOCIATE LEARNING

The learning series consisted of learning to associate three pairs of nonsense syllables by means of the anticipation method. The syllables were presented by means of a tape recorder so that the stimulus syllable was pronounced first. This was followed by a pure tone indicating the subject should respond with the appropriate response syllable. Finally the stimulus syllable followed by the response syllable was given. This procedure was followed for

each of the three pairs. The presentation and the time interval between each part was constant. Different orders of the syllable pairs were used on successive trials to eliminate serial learning. The series of pairs was repeated until the subject was able to respond correctly to two successive series.

The background condition consisted of having the pairs of syllables presented with accompanying background noise.

VISUAL-AUDITORY LEARNING TASK

Only a single task requiring both vision and audition for learning was used. It consisted of three figures drawn on 5 x 8 inch cards (learning and stimulus) paired with three nonsense syllables, Appendix F. One series consisted of 36 cards (18 learning and 18 stimulus) and 18 syllables presented in a pre-arranged, non-serial order. The subject would first be shown a stimulus card. After an interval allowing for his response, he was simultaneously shown a similar card (learning) and heard the correct response. This was repeated for pairs two and three. The presentation continued (in differing order) until the subject could respond to the stimulus cards correctly for two series of three each. The number of trials required was scored.

The background condition consisted of having the learning and stimulus cards covered with overlapping arcs and taped auditory background noise.

DIAGNOSTIC ACHIEVEMENT TESTS

The Primary Mental Abilities Test was administered on a group basis to the children. The forms used for these two tests were appropriate to the mental age of the child as determined from the WISC.

The Botel Reading Inventory was administered to each child according to the instructions found in the test. The Developmental Test of Visual Perception was administered on a group basis. This test, as well as the Illinois Test of Psycholinguistic Ability, which is an individual test, are still in the experimental stage, but were used in this study in the hope of discovering their correlation to other established tests as well as the learning tasks. Descriptions of these tests can be obtained from the manuals accompanying the tests.

CHAPTER IV

RESULTS

The results related to the visual learning tasks are based upon the data obtained from 49 educable mentally retarded children with varying degrees of visual and auditory perceptual disorders. An N of 28 was used for the auditory learning tasks and for the visual-auditory learning task. The findings will be reported in terms of intercorrelations and t tests.

The data will be reported in the following manner. First, each visual learning task will be considered as to differences between background and no background administration. Each test will then be reported on as to correlations with chronological age, mental age, intelligence quotient, Syracuse Visual Figure-Background Test, Syracuse Auditory Figure-Background Test, and the figure-background tests combined. Second, each auditory learning task will be reported in the same way as the visual learning tasks with the exception of correlations with C.A., M.A., and I.Q. Third, the visual-auditory learning task will be reported in the same way as the auditory learning tasks. Fourth, the intercorrelations among the visual learning tasks will be reported. Fifth, the intercorrelations among the visual learning tasks and the diagnostic and achievement tests will be presented.

VISUAL LEARNING TASKS

SERIAL LEARNING

Analysis of t test. When comparing the scores obtained with and without background interference present, no statistically significant difference was found, Table III.

Intercorrelations. Table IV contains the intercorrelations of the diagnostic tests and the various scores obtained from the several tasks related to visual Serial Learning. In considering correlations between chronological age

TABLE III

TABLE OF t RATIOS FOR THE VISUAL LEARNING TASKS

TASK	COMBINATION	CONDITION	t
Serial Learning	Lng-Lng	BG-NBG	.003
Paired Associate Learning	Lng-Lng	BG-NBG	.56
	Trf-Trf	BG-NBG	.09
	Lng-Trf	NBG-NBG	1.83
	Lng-Trf	BG-BG	2.07**
Coding Learning	Lng-Lng	BG-NBG	1.24
	PI-PI	BG-NBG	1.35
	Lng-PI	BG-BG	1.62
	Lng-PI	NBG-NBG	1.27
	Err Lng-Err Lng	BG-NBG	3.59*
	Err PI-Err PI	BG-NBG	6.46*
	Err Lng-Err PI	BG-BG	3.82*
	Err Lng-Err PI	NBG-NBG	5.85*
Discrimination Learning	Lng-Trf	NBG-NBG	.68
	Err-Err	NBG-NBG	1.44
	Lng-Trf	BG-BG	.59
	Err-Err	BG-BG	.69
	Lng-Lng	BG-NBG	.84
	Lng Err-Lng Err	BG-NBG	1.11
	Trf-Trf	BG-NBG	.91
	Trf Err-Trf-Err	BG-NBG	
Concept Formation Learning	Lng-Lng	BG-NBG	1.04

* Significant at the .01 level.

** Significant at the .05 level.

Lng - Learning
 Trf - Transfer
 PI - Proactive Inhibition
 Err - Error
 BG - Background interference present
 NBG - No background interference present

and the learning trial of the Serial Learning task where a low score was indicative of rapid learning, a significant correlation of $-.49$ was obtained with no background interference, and a significant correlation of $-.53$ was obtained with background interference. The older the child, the fewer trials were necessary to learn the task.

When the correlation between mental age and the learning trials were considered, a positive significant correlation of $.52$ was obtained with no background and a significant correlation of $.37$ was obtained with background interference. The older the child mentally, the more trials he required to successfully complete the task.

This task (with and without background) showed no significant correlation with I.Q., Syracuse Visual Figure-Background Test, the Syracuse Auditory Figure-Background Test, nor the combined SVFBT - SAFBT.

On the next test of Serial Learning, the subjects were asked to recognize from a sheet of 72 nonsense syllables, the syllables they had been asked to learn on the initial test. No significant correlations were evident with the six variables (C.A., M.A., I.Q., SVFBT, SAFBT, and combined SVFBT and SAFBT) that were of concern.

As part of the Serial Learning Recognition Test, the number of nonsense syllables incorrectly circled was counted and is reported as the Error Score. A t test applied to this test, background versus no background, yielded a t of $.80$ which was not significant. This error score showed correlations of $-.31$ and $-.28$, significant at $.05$ with no background and with background interference respectively with C.A. As one might expect, the older the subject, the less errors he made. When correlated with mental age, the tasks yielded significant ($.05$) correlations of $-.28$ and $-.33$ with no background and with background interference respectively. The older the child was mentally, the less errors he made. No other significant correlations were evident on either the

TABLE IV

CORRELATIONS AMONG THE DIAGNOSTIC TESTS
AND VISUAL SERIAL LEARNING, RECOGNITION, RECALL, AND ERRORS.
NO BACKGROUND AND BACKGROUND

Task	C.A.	M.A.	I.Q.	SVFBT	SAFBT	Combined SVFBT-SAFBT
Serial Learning NBG	-.49*	.52*	-.17	-.14	.007	-.08
Serial Learning BG	-.53*	.37**	.14	-.09	-.15	-.15
Recognition NBG	.05	.07	.11	-.20	.10	-.06
Recognition BG	-.01	-.14	-.21	.04	.27	.20
Error NBG	-.31**	-.28**	-.04	-.15	.02	-.09
Error BG	-.28**	-.33**	-.11	-.22	.02	-.13
Recall NBG	.04	.10	.27	-.14	-.009	-.10
Recall BG	.15	.13	-.03	-.004	-.19	-.13

* Significant at the .01 level. NBG - No Background Interference Present.
** Significant at the .05 level. BG - Background Interference Present.
SVFBT- Syracuse Visual Figure-Background Test.
SAFBT- Syracuse Auditory Figure-Background Test.

TABLE V

CORRELATIONS AMONG THE DIAGNOSTIC TESTS
AND VISUAL PAIRED ASSOCIATES LEARNING AND TRANSFER
NO BACKGROUND AND BACKGROUND

Task	C.A.	M.A.	I.Q.	SVFBT	SAFBT	Combined SVFBT-SAFBT
Paired Associate Learning - NBG	.52*	.57*	.24	.10	.08	.12
Paired Associate Learning - BG	.45*	.54*	.30**	.08	-.13	-.03
Transfer Learning NBG	.54*	.58*	.24	.18	.04	.09
Transfer Learning BG	.40*	.43*	.29**	.13	-.14	-.05

* Significant at the .01 level. NBG - No Background Interference Present.
** Significant at the .05 level. BG - Background Interference Present.
SVFBT - Syracuse Visual Figure-Background Test.
SAFBT - Syracuse Auditory Figure-Background Test.

background or no background administrations of the Serial Learning Error Task.

The fourth Serial Learning Task was concerned with the number of syllables correctly recalled on the first trial of the Serial Learning Retest. Neither Recall with background interference nor Recall with no background interference were significantly correlated with the other variables.

PAIRED ASSOCIATE LEARNING

Analysis of t test. When compared statistically, the means from the paired associate learning task and the Paired Associate Transfer task with no background disturbance, did not differ significantly from the corresponding means obtained with background interference. A number of t tests were also computed for the purpose of comparing the means between learning and transfer trials of both the background and no background tasks. The t ratio between learning and transfer means with no background was 1.83 which was not significant. The t ratio between learning and transfer of the background task was 2.068 which was significant at the .05 level. In other words, statistically significant transfer did not take place on the no background interference task. Transfer did take place on the Paired Associate task that included a visual and auditory background interference.

Intercorrelations. Table V contains the intercorrelations of the diagnostic tests and visual Paired Associate Learning and Transfer tasks. All the Paired Associate tasks were significantly correlated with both C.A. and M.A. beyond the .01 level. Paired Associate Learning and Transfer with background interference were significantly correlated with I.Q. at the .05 level of confidence. The older the subjects, chronologically and mentally, the higher his score on Paired Associate Learning and Transfer. This was true both with and with no background interference. Also, the higher the I.Q., the higher the subject's score under both learning conditions, significantly so under the condition of with background interference. Paired Associate Learning and Transfer

with background interference and with no background interference did not correlate significantly with the Syracuse Visual Figure-Background Test, the Syracuse Auditory Figure-Background Test, nor the combined SVFBT-SAFBT.

CODING LEARNING

Analysis of t tests. On this learning task, four administrations were required to obtain the necessary data. The subjects were given the Coding task with either a background present or absent, dependent upon which group they were in. Immediately upon finishing the task, they were administered a similar task with different symbols but identical learning conditions to measure proactive inhibition. The next time they were given the task under opposite learning conditions with or with no background interference, again dependent upon which group they were in. The proactive inhibition task was administered immediately following. The t score for learning with background interference versus learning with no background interference showed no significant differences. There were also no significant differences in amounts of proactive inhibition between with background interference and with no background interference administrations. There were no significant differences found between number correct with background interference in the initial learning and number correct with background interference in the proactive inhibition trial. The same held true for those correct with no background interference. However, in relation to error scores, significantly more errors were made with background interference in comparison to with no background interference, both on the initial trials and on the proactive inhibition trials. Significantly more errors were also found in proactive inhibition over the initial trial both with and with no background interference. In short, with background or with no background interference makes little difference for the initial learning trial. Proactive inhibition takes place in the form of more errors, especially so when the background interference is present.

Intercorrelations. Table VI contains the intercorrelations among the results of the diagnostic tests and the visual Coding Learning and Proactive Inhibition tasks both with and with no background interference. As far as the six variables are concerned, all four facets of the Coding task were significantly correlated with C.A. and M.A. The initial Coding Learning with background interference was significantly correlated with C.A. and M.A. at the .05 level while the other three facets were significantly correlated beyond the .01 level.

Intelligence Quotient was significantly correlated with Coding Proactive Inhibition with background interference at the .05 level of confidence but not with the other facets of the Coding tasks. The Syracuse Visual Figure-Background Test (SVFBT) was significantly correlated with the learning trials with and with no background interference at the .05 level of confidence. No significant correlations were evidenced between the Syracuse Auditory Figure-Background Test (SAFBT) and the four facets of the Coding tasks. The combined Visual and Auditory background scores were not significantly correlated with any of the facets of the Coding tasks.

DISCRIMINATION LEARNING

Analysis of t tests. All comparisons concerned with the Discrimination task with no background interference (learning to transfer, error to error), Table III, failed to yield significant differences as did all comparisons within the Discrimination task with background interference. Furthermore, all comparisons between with background and with no background interference (learning to learning, error to error, transfer to transfer, error to error) failed to yield significant differences.

Intercorrelations. Numerous significant correlations were found, but they failed to follow any predictable order, Table VII. The scores are reported either in terms of time or errors. Consequently, negative correlations (with C.A. and M.A.) were expected. Discrimination Time Learning with no background

TABLE VI

CORRELATIONS AMONG THE DIAGNOSTIC TESTS AND
VISUAL CODING LEARNING AND PROACTIVE INHIBITION TASKS
NO BACKGROUND AND BACKGROUND

Task	C.A.	M.A.	I.Q.	SVFBT	SAFBT	Combined SVFBT-SAFBT
Coding Learning NBG	.46*	.44*	.07	.29**	-.11	.12
Coding Learning BG	.36**	.33**	-.02	.29**	-.05	.15
Coding Proactive Inhibition - NBG	.46*	.47*	.10	.21**	-.14	.05
Coding Proactive Inhibition - BG	.58*	.66*	.29**	.27**	-.01	.17

* Significant at the .01 level. NBG - No Background Interference Present.
 ** Significant at the .05 level. BG - Background Interference Present.
 SVFBT - Syracuse Visual Figure-Background Test.
 SAFBT - Syracuse Auditory Figure-Background Test.

TABLE VII

CORRELATIONS AMONG THE DIAGNOSTIC TESTS AND VISUAL DISCRIMINATION
LEARNING (TIME), DISCRIMINATION ERROR, DISCRIMINATION TRANSFER LEARNING
(TIME), AND DISCRIMINATION TRANSFER ERROR
NO BACKGROUND AND BACKGROUND

Task	C.A.	M.A.	I.Q.	SVFBT	SAFBT	Combined SVFBT-SAFBT
Discrimination Learning - NBG	-.65*	-.71*	-.29**	-.26	.08	-.12
Discrimination Learning - BG	-.66*	-.74*	-.35**	-.26	.004	-.17
Discrimination Error - NBG	-.17	-.28**	-.29**	.19	.02	.14
Discrimination Error - BG	-.13	-.31**	-.46*	.03	.008	.03
Discrimination Transfer Learning NBG	-.66*	-.71*	-.31**	-.33**	-.06	-.25
Discrimination Transfer Learning-BG	-.62*	-.68*	-.28**	-.33**	.001	-.21
Discrimination Transfer Error - NBG	.10	-.03	-.22	.11	-.06	.03
Discrimination Transfer Error - BG	.05	-.12	-.35**	.04	.10	.09

* Significant at the .01 level. NBG - No Background Interference Present.
 ** Significant at the .05 level. BG - Background Interference Present.
 SVFBT - Syracuse Visual Figure-Background Test.
 SAFBT - Syracuse Auditory Figure-Background Test.

interference was significantly correlated with C.A. and M.A. at the .01 level and with I.Q. at the .05 level. It was not significantly correlated with SVFBT or the SAFBT. Discrimination Error Learning with no background interference was significantly negatively correlated with M.A. and I.Q. at the .05 level, but was not significantly correlated with C.A., SVFBT, or SAFBT. Discrimination Time Transfer with no background was significantly negatively correlated with C.A. and M.A. at the .01 level and I.Q. and SVFBT at the .05 level. It was not significantly correlated with the SAFBT. Discrimination Error Transfer with no background evidenced no significant relationship with the variables concerned. Discrimination Time Learning with background interference was significantly negatively correlated with C.A. and M.A. at the .01 level and with I.Q. at the .05 level. It was not significantly correlated with the SVFBT or the SAFBT. Discrimination Error Learning with background interference was significantly negatively correlated with M.A. at the .05 level and with I.Q. at the .01 level. Discrimination Time Transfer with background interference was significantly negatively correlated with C.A. and M.A. at the .01 level and with I.Q. and the SVFBT at the .05 level. It was not significantly correlated with the SAFBT. Discrimination Error Transfer with background interference was significantly negatively correlated with I.Q. at the .05 level but failed to yield other significant correlations.

These trends toward negative correlation follow the expected direction as a lower score in time means more rapid facilitations of discrimination. With one or two exceptions, the times scores seem to be functions of chronological age and mental age. The error scores appear to be less related. The I.Q. score appeared to be significantly correlated to all the facets of Discrimination Learning except in the Error Transfer score with no background interference.

CONCEPT FORMATION LEARNING

Analysis of t tests. On Concept Formation, the only t's considered were in terms of learning with background interference compared to learning with no background interference, Table VI. This t showed no significant difference. In other words, background interference did not appear to effect subjects' performance on the learning task when compared with the results of the learning task administered with no background interference.

Intercorrelations. Table VIII contains the intercorrelations among the diagnostic tests and Concept Formation Learning with and with no background interference. Concept Formation Learning with no background interference was significantly correlated with chronological age at the .05 level, and significantly negatively correlated with mental age at the .05 level. In other words, the older the child, the more trials required for him to learn the concept. The higher the mental age, however, the less trials required, which was in the direction expected.

TABLE VIII

CORRELATIONS AMONG THE DIAGNOSTIC TESTS
AND VISUAL CONCEPT FORMATION LEARNING
NO BACKGROUND AND BACKGROUND

Task	C.A.	M.A.	I.Q.	SVFBT	SAFBT	Combined SVFBT-SAFBT
Concept Formation Learning - NBG	.27**	-.34**	-.14	-.02	-.05	-.05
Concept Formation Learning - BG	-.21	-.36**	-.33**	-.08	.05	-.02

** Significant at the .05 level.

SVFBT - Syracuse Visual Figure-Background Test.

SAFBT - Syracuse Auditory Figure-Background Test.

NBG - No Background Interference Present

BG - Background Interference Present.

Concept Formation Learning with background interference was not significantly correlated with chronological age but was significantly negatively correlated with mental age and I.Q. at the .05 level of confidence. This evidence indicates that with background interference present, chronological age does not appear to be a factor in grasping the concept but the higher mentally the individual and the higher his I.Q. the more likely he is to grasp the concept with fewer trials. Again, these latter results are in the direction expected. No significant correlations were found for the SVFBT and the SAFBT with the Concept Formation tasks.

AUDITORY LEARNING TASKS

SERIAL LEARNING

Analysis of t tests. Seven different t tests were calculated to determine the effect of figure-background disturbance and learning conditions (with background and with no background interference) on Auditory Serial Learning, Table IX. For six of the analyses only a part of the total group was used: those who scored low (few background responses) on the Syracuse Visual Figure-Background Test and those who scored high (many background responses) on the Syracuse Visual Figure-Background Test; those who scored low on the Syracuse Auditory Figure-Background Test and those who scored high on the Syracuse Auditory Figure-Background Test; and those who scored low on the combined SVFBT - SAFBT and those who scored high on the combined SVFBT - SAFBT. The final t test was calculated using the total group under conditions with background and with no background interference in the learning situation. None of the analyses indicated there was a significant difference between the performances of the several groups.

Intercorrelations. Table X contains the results of the correlations among the background diagnostic tests and Auditory Serial Learning. Only one correlation (Serial Learning with no background interference and the Syracuse

TABLE IX
TABLE OF t RATIOS FOR THE AUDITORY LEARNING TASKS

Task	Combination	Condition	t
Serial Learning	low SVFBT - High SVFBT	NBG - NBG	0.62
	low SVFBT - High SVFBT	BG - BG	0.32
	low SAFBT - High SAFBT	NBG - NBG	1.04
	low SAFBT - High SAFBT	BG - BG	0.19
	low combined - high combined		
	SVFBT-SAFBT - SVFBT-SAFBT	NBG-NBG	0.12
	low combined - high combined		
	SVFBT-SAFBT - SVFBT-SAFBT	BG-BG	0.30
Paired Associate Learning	Lng - Lng	BG-NBG	0.24
	low SVFBT - High SVFBT	NBG - NBG	0.38
	low SVFBT - High SVFBT	BG - BG	0.67
	low SAFBT - High SAFBT	NBG - NBG	0.44
	low SAFBT - High SAFBT	BG - BG	0.08
	low combined - high combined		
	SVFBT-SAFBT - SVFBT-SAFBT	NBG - NBG	0.26
	low combined - high combined		
	SVFBT-SAFBT - SVFBT-SAFBT	BG - BG	0.49
	Lng - Lng	BG - NBG	0.96

SVFBT - Syracuse Visual Figure-Background Test.
SAFBT - Syracuse Auditory Figure-Background Test.
NBG - No Background Interference Present.
BG - Background Interference Present.
Lng - Learning

TABLE X
CORRELATIONS AMONG THE DIAGNOSTIC TESTS AND
AUDITORY SERIAL LEARNING AND PAIRED ASSOCIATE LEARNING
NO BACKGROUND AND BACKGROUND

Task	SVFBT	SAFBT	Combined SVFBT - SAFBT
Serial Learning NBG	-.09	.37**	.15
Serial Learning BG	.003	.11	.06
Paired Associate Learning - NBG	.13	.09	.17
Paired Associate Learning - BG	.18	.12	.21

** Significant at the .05 level
SVFBT - Syracuse Visual Figure-Background Test.
SAFBT - Syracuse Auditory Figure-Background Test.
NBG - No Background Interference Present.
BG - Background Interference Present.

Auditory Figure--Background Test) was significant at the .05 level of confidence. All other correlations, Serial Learning with no background interference and the Syracuse Visual Figure-Background Test and the combined SVFBT - SAFBT as well as Serial Learning with background interference and the Syracuse Visual Figure-Background Test, the Syracuse Auditory Figure-Background Test and the combined SVFBT- SAFBT were not significant.

PAIRED ASSOCIATE LEARNING

Analysis of t test. The analysis of the Auditory Paired Associates Learning data was conducted in the same fashion as the data from the Auditory Serial Learning Tasks, Table IX. High and low visual and auditory background test groups were selected and their learnings examined in relation to with background or with no background interference learning conditions. The total group data was also examined for the effect of the two learning conditions. There were no significant differences between the performances of the several groups.

Intercorrelations. The correlations among the background tests (visual, auditory, and combined visual-auditory) and auditory Paired Associate Learning are contained in Table X. None of the correlations were significant whether the learning condition was with background interference or with no background interference.

VISUAL-AUDITORY LEARNING TASK (Paired Associate Learning)

This task was the most difficult one given the children in terms of the number of trials required to reach criterion. It was also the only learning task that required the use of both the visual and auditory sense modalities in order to accomplish the task.

Analysis of t tests. Seven different t tests were calculated to determine whether or not figure-background disturbance and learning conditions (with background and with no background interference) had any effect upon visual-

auditory Paired Associate Learning, Table XI. Six of the analyses used extreme sub-groups - those who scored low (few background responses) and those who scored high (many background responses) on the Syracuse Visual Figure-Background Test, the Syracuse Auditory Figure-Background Test, and the combined SVFBT-SAFBT. The analyses were also made in consideration of the learning condition - with no background interference and with background interference. The final analysis was made using the total group and was concerned with the learning of the visual-auditory Paired Associate task under the conditions with background interference and with no background interference. None of the differences was significant.

Intercorrelations. Table XII contains the correlations among the background diagnostic tests and visual-auditory Paired Associate Learning with no background interference and with background interference conditions. None of the correlations was significant.

CORRELATIONS AMONG LEARNING TASKS

No t tests were calculated to determine whether or not there were any differences between the abilities of the children as measured by the various learning tasks. Any results of this type would have been of no value for the present study as well as meaningless due to the varied scoring procedures used. The following correlational results are reported for the visual learning tasks only and as patterns and trends rather than by individual correlations.

SERIAL LEARNING

When considered as a whole, Serial Learning showed relatively few significant correlations with the other learning tests, Table XIII. If the Recognition, Error, and Recall results are omitted and only the learning scores (both with no background interference and with background interference) are considered, Table XIV, the relative number of significant correlations increases markedly. Of the 15 correlations using Serial Learning Learning with no background interference conditions with other learning and transfer scores, 10 are significant

TABLE XI

TABLE OF t RATIOS FOR
THE VISUAL-AUDITORY PAIRED ASSOCIATE LEARNING

Task	Combination	Condition	t
Paired Associate Learning	low SVFBT - High SVFBT	NBG - NBG	0.32
	low SVFBT - High SVFBT	BG - BG	0.33
	low SAFBT - High SAFBT	NBG - NBG	0.93
	low SAFBT - High SAFBT	BG - BG	0.64
	Low Combined - High Combined		
	SVFBT-SAFBT - SVFBT-SAFBT	NBG - NBG	0.08
	Low Combined - High Combined		
	SVFBT-SAFBT - SVFBT-SAFBT	BG - BG	0.36
	Lng - Lng	BG -NBG	1.86

SVFBT - Syracuse Visual Figure-Background Test.
SAFBT - Syracuse Auditory Figure-Background Test.
NBG - No Background Interference Present.
BG - Background Interference Present.
Lng - Learning

TABLE XII

CORRELATIONS AMONG THE DIAGNOSTIC
TESTS AND VISUAL-AUDITORY PAIRED ASSOCIATE LEARNING
NO BACKGROUND AND BACKGROUND

Task	SVFBT	SAFBT	Combined SVFBT-SAFBT
Paired Associate Learning - NBG	.12	-.17	-.01
Paired Associate Learning - BG	.14	-.09	.02

SVFBT--Syracuse Visual Figure-Background Test.
SAFBT--Syracuse Auditory Figure-Background Test.
NBG --No Background Interference Present.
BG --Background Interference Present.

TABLE XIII

INTERCORRELATIONS AMONG VISUAL LEARNING TASKS,
INCLUDING LEARNING, TRANSFER, RECOGNITION,
RECALL, PROACTIVE INHIBITION, AND ERROR
NO BACKGROUND AND BACKGROUND

	Serial Learning Learning - NBG	Serial Learning Recognition - NBG	Serial Learning Error - NBG	Serial Learning Recall - NBG	Serial Learning Learning - BG	Serial Learning Recognition - BG	Serial Learning Error - BG	Serial Learning Recall - BG
Serial Learning Learning - NBG		-.02	.31**	-.07	.59*	-.06	.30**	-.26
Serial Learning Recognition - NBG	-.02		.33**	.27	-.08	.35	.46*	.05
Serial Learning Error - NBG	.31	.33**		-.17	.32**	.46*	.81*	-.28**
Serial Learning Recall - NBG	-.07	.27	-.17		-.23	-.09	-.03	.15
Serial Learning Learning - BG	.59*	-.08	.32**	-.23		-.17	-.22	-.31**
Serial Learning Recognition - BG	-.06	.35**	.46*	-.09	-.17		.64*	.05
Serial Learning Error - BG	.30**	.46*	.81*	-.03	-.22	.64*		-.17
Serial Learning Recall - BG	-.26	.05	-.28**	.15	-.31	.05	-.17	
Paired Associate Learning - NBG	-.53*	.09	-.39*	.06	-.51*	-.07	-.39*	.22
Paired Associate Transfer - NBG	-.69*	.03	-.40*	-.02	-.60*	.03	-.35**	.35**
Paired Associate Learning - BG	-.46*	-.10	-.45*	.19	-.43*	-.15	-.38*	.34**
Paired Associate Transfer - BG	-.43*	.08	-.42*	.23	-.50*	-.09	.37*	.46*
Coding Learning - NBG	-.29**	-.01	-.23	.15	-.15	-.16	-.19	.19
Coding Proactive Inhibition - NBG	-.27	-.07	-.24	.12	-.09	-.16	-.16	.20

TABLE XIII

INTERCORRELATIONS AMONG VISUAL LEARNING TASKS,
INCLUDING LEARNING, TRANSFER, RECOGNITION,
RECALL, PROACTIVE INHIBITION, AND ERROR
NO BACKGROUND AND BACKGROUND

	Serial Learning Learning - NBG	Serial Learning Recognition - NBG	Serial Learning Error - NBG	Serial Learning Recall - NBG	Serial Learning Learning - BG	Serial Learning Recognition - BG	Serial Learning Error - BG	Serial Learning Recall - BG
Coding Learning - BG	-.10	-.04	-.23	.09	-.06	-.29**	-.24	.13
Coding, Proactive Inhibition - BG	-.45	.24	-.27	.26	-.38*	-.06	-.10	.15
Discrimination Learning - NBG	.41*	-.22	.14	-.05	.23	-.04	.06	-.18
Discrimination Error, Learning-NBG	.11	.01	.09	.09	-.01	-.10	-.06	-.01
Discrimination Transfer - NBG	.45*	-.20	.22	-.03	.29**	-.03	.08	-.10
Discrimination Error, Transfer-NBG	-.04	-.16	-.08	.04	-.12	-.10	-.13	.21
Discrimination Learning - BG	.49*	-.19	.18	-.08	.30**	-.04	.07	-.11
Discrimination Error, Learning-BG	.30**	-.25	-.01	.10	.07	-.14	-.12	.17
Discrimination Transfer - BG	.57*	-.18	.16	.03	.25	-.09	.08	-.12
Discrimination Error, Transfer-BG	.01	-.18	.01	.12	-.10	.03	-.07	.16
Concept Formation Learning - NBG	.30**	-.04	-.09	-.09	.28**	-.12	.07	.01
Concept Formation Learning - BG	.30**	-.002	.28**	-.23	.24	.26	.33**	-.01

* Significant at the .01 level.

** Significant at the .05 level.

NBG - No Background Interference Present.

BG - Background Interference Present.

TABLE XIII (Cont'd.)

INTERCORRELATIONS AMONG VISUAL LEARNING TASKS,
INCLUDING LEARNING, TRANSFER, RECOGNITION,
RECALL, PROACTIVE INHIBITION, AND ERROR,
NO BACKGROUND AND BACKGROUND

	Paired Associate Learning - NBG	Paired Associate Transfer - NBG	Paired Associate Learning - BG	Paired Associate Transfer - BG	Coding Learning NBG	Coding Proactive Inhibition - NBG	Coding Learning BG	Coding Proactive Inhibition - BG
Serial Learning Learning - NBG	-.53*	-.69*	-.46*	-.43*	-.29**	-.27	-.10	-.45*
Serial Learning Recognition - NBG	.09	.03	-.10	.08	-.01	-.07	-.04	.24
Serial Learning Error - NBG	-.39*	-.40*	-.45*	-.45*	-.23	-.24	-.23	-.27
Serial Learning Recall - NBG	.06	-.02	.19	.23	.15	.12	.09	.26
Serial Learning Learning - BG	-.51*	.60*	-.43*	-.50*	-.15	-.09	-.06	-.38*
Serial Learning Recognition - BG	-.07	.03	-.15	-.09	-.16	-.16	-.29**	-.06
Serial Learning Error - BG	-.39*	-.35**	-.38*	-.37*	-.19	-.16	-.24	-.10
Serial Learning Recall - BG	.22	.35**	.34**	.46*	.19	.20	.13	.15
Paired Associate Learning - NBG		.77*	.52*	.54*	.18	.17	.02	.35**
Paired Associate Transfer - NBG	.77*		.58*	.58*	.25	.24	.13	.52*
Paired Associate Learning - BG	.52*	.58*		.80*	.28**	.31**	.23	.64*
Paired Associate Transfer - BG	.54*	.58*	.80*		.13	.16	.06	.45*
Coding Learning - NBG	.18	.25	.28**	.13		.93*	.86*	.46*
Coding, Proactive Inhibition - NBG	.17	.24	.31**	.16	.93*		.79*	.53*

TABLE XIII (Cont'd.)

INTERCORRELATIONS AMONG VISUAL LEARNING TASKS,
INCLUDING LEARNING, TRANSFER, RECOGNITION,
RECALL, PROACTIVE INHIBITION, AND ERROR,
NO BACKGROUND AND BACKGROUND

	Paired Associate Learning - NBG	Paired Associate Transfer - NBG	Paired Associate Learning - BG	Paired Associate Transfer - BG	Coding Learning NGB	Coding Proactive Inhibition - NBG	Coding Learning BG	Coding Proactive Inhibition - BG
Coding Learning - BG	.02	.13	.23	.06	.86*	.79*		.43*
Coding, Proactive Inhibition - BG	.35**	.52*	.64*	.45*	.46*	.53*	.43*	
Discrimination Learning - NBG	-.48*	-.53*	-.47*	-.40*	-.39*	-.40*	-.23	-.62*
Discrimination Error, Learning-NBG	-.10	-.16	-.01	-.06	-.05	-.07	-.23	-.13
Discrimination Transfer - NBG	-.51*	-.58*	-.54*	-.39*	-.50*	-.51*	-.31**	-.74*
Discrimination Error, Transfer-NBG	-.14	-.18	.06	-.02	-.07	.10	-.01	-.07
Discrimination Learning - BG	-.44*	-.63*	-.50*	-.37*	-.40*	-.40*	-.25	-.73*
Discrimination Error, Learning-BG	-.26	-.47*	-.31**	-.31**	.26	.20	.30**	-.38*
Discrimination Transfer - BG	-.42*	-.65*	-.54*	-.37*	-.49*	-.50*	-.32**	-.69*
Discrimination Error-Transfer-BG	-.01	-.28**	-.11	-.03	.30**	.29**	.11	-.23
Concept Formation Learning - NBG	-.30**	-.25	-.24	-.27	-.35**	-.32**	-.20	-.11
Concept Formation Learning - BG	-.33**	-.37*	-.30**	-.26	.05	.03	.02	-.39*

* Significant at the .01 level.

** Significant at the .05 level.

NBG - No Background Interference Present.

BG - Background Interference Present.

TABLE XIII (Cont'd.)

INTERCORRELATIONS AMONG VISUAL LEARNING TASKS,
INCLUDING LEARNING, TRANSFER, RECOGNITION,
RECALL, PROACTIVE INHIBITION, AND ERROR
NO BACKGROUND AND BACKGROUND

	Discrimination Learning - NBG	Discrimination Error, Learning - NBG	Discrimination Transfer - NBG	Discrimination Error Transfer - NBG	Discrimination Learning - BG	Discrimination Error Learning - BG	Discrimination Transfer - BG	Discrimination Error Transfer - BG	Concept Formation Learning - NBG	Concept Formation Learning - BG
Serial Learning Learning - NBG	.41*	.11	.45*	-.04	.49*	.30**	.57*	.01	.30**	.30**
Serial Learning Recognition - NBG	-.22	.01	-.20	-.16	-.19	-.25	-.18	-.18	-.04	-.002
Serial Learning Error - NBG	.14	.09	.22	-.08	.18	-.01	.16	.01	-.09	-.28**
Serial Learning Recall - NBG	-.05	.09	-.03	.04	-.08	.10	.03	.12	-.09	-.23
Serial Learning Learning - BG	.23	-.01	.29**	-.12	.30**	.07	.25	-.10	.28**	.24
Serial Learning Recognition - BG	-.04	-.10	-.03	-.10	-.04	-.14	-.09	.03	-.12	.26
Serial Learning Error - BG	.06	-.06	.08	-.13	.07	-.12	.08	-.07	.07	.33**
Serial Learning Recall - BG	-.18	-.01	-.10	.21	-.11	.17	-.12	.16	.01	-.01
Paired Associate Learning - NBG	-.48*	-.10	-.51*	-.14	-.44*	-.26	-.42*	-.01	-.30**	-.33**
Paired Associate Transfer - NBG	-.53*	-.16	-.58*	-.18	-.63*	-.47*	-.65*	-.28**	-.25	-.37*
Paired Associate Learning - BG	-.47*	-.01	-.54*	.06	-.50*	-.31**	-.54*	-.11	-.24	-.30**
Paired Associate Transfer - BG	-.40*	-.06	-.39*	-.02	-.37*	-.31**	-.37*	-.03	-.27	-.26
Coding Learning - NBG	-.39*	-.05	-.50*	-.07	-.40*	.26	-.49*	.30**	-.35**	.05
Coding, Proactive Inhibition - NBG	-.40*	-.07	-.51*	.10	-.40*	.20	-.50*	.29**	.32**	.03

TABLE XIII (Cont'd.)

INTERCORRELATIONS AMONG VISUAL LEARNING TASKS,
INCLUDING LEARNING, TRANSFER, RECOGNITION,
RECALL, PROACTIVE INHIBITION, AND ERROR
NO BACKGROUND AND BACKGROUND

	Discrimination Learning - NBG	Discrimination Error, Learning - NBG	Discrimination Transfer - NBG	Discrimination Error Transfer - NBG	Discrimination Learning - BG	Discrimination Error Learning - BG	Discrimination Transfer - BG	Discrimination Error Transfer - BG	Concept Formation Learning - NBG	Concept Formation Learning - BG
Coding Learning - BG	-.23	-.23	-.31**	-.01	-.25	.30**	-.32**	.11	-.20	.02
Coding, Proactive Inhibition - BG	-.62*	-.13	-.74*	-.07	-.73*	-.38*	-.69*	-.23	-.11	-.39*
Discrimination Learning - NBG		.32*	.86*	.01	.83*	.32**	.82*	.12	.22	.17
Discrimination Error, Learning-NBG	.32**		.26	.42*	.26	.37*	.21	.24	-.09	.06
Discrimination Transfer - NBG	.86*	.26		-.27	.87*	.37*	.86*	.12	.18	.15
Discrimination Error, Transfer-NBG	.01	.42*	-.27		.05	.45*	.04	.53*	.35**	.15
Discrimination Learning - BG	.83*	.26	.87*	.05		.48*	.94*	.27	.16	.32**
Discrimination Error, Learning-BG	.32**	.37*	.37*	.45*	.48*		.45*	.66*	.06	.26
Discrimination Transfer - BG	.82*	.21	.86*	.04	.94*	.45*		.17	.22	.17
Discrimination Error, Transfer-BG	.12	.24	.12	.53*	.27	.66*	.17		-.22	.42*
Concept Formation Learning - NBG	.22	-.09	.18	.35**	.16	.06	.22	-.22		-.04
Concept Formation Learning - BG	.17	.06	.15	.15	.32**	.26	.17	.42*	-.04	

* Significant at the .01 level.

** Significant at the .05 level.

NBG - No Background Interference Present.

BG - Background Interference Present.

TABLE XIV

INTERCORRELATIONS AMONG VISUAL LEARNING AND TRANSFER TASKS ONLY
NO BACKGROUND AND BACKGROUND

	Serial Learning Learning - NBG	Serial Learning Learning - BG	Paired Associate Learning - NBG	Paired Associate Learning - BG	Paired Associate Transfer - NBG	Paired Associate Transfer - BG	Coding Learning NGB	Coding Learning BG
Serial Learning Learning - NBG		.59*	-.53*	-.46*	-.69*	-.43*	-.29**	-.10
Serial Learning Learning - BG	.59*		-.51*	-.43*	-.60*	-.50*	-.15	-.06
Paired Associate Learning - NBG	-.53*	-.51*		.52*	.77*	.54*	.18	.02
Paired Associate Learning - BG	-.46*	-.43*	.52*		.58*	.80*	.28**	.23
Paired Associate Transfer - NBG	-.69*	-.60*	.77*	.58*		.58*	.25	.13
Paired Associate Transfer - BG	-.43*	-.50*	.54*	.80*	.58*		.13	.06
Coding Learning NGB	-.29**	-.15	.18	.28**	.25	.13		.86*
Coding Learning BG	-.10	-.06	.02	.23	.13	.06	.86*	
Coding, Proactive Inhibition - NBG	-.27	-.09	.17	.31**	.24	.16	.93*	.79*
Coding, Proactive Inhibition - BG	-.45*	-.38*	.35**	.64*	.52*	.45*	.46*	.43*
Discrimination Learning - NBG	.41*	.23	-.48*	-.47*	-.53*	-.40*	-.39*	-.23
Discrimination Learning - BG	.49*	.30**	-.44*	-.50*	-.63*	-.37*	-.40*	-.25
Discrimination Transfer - NBG	.45*	.29**	-.51*	-.54*	-.58*	-.39*	-.50*	-.31**
Discrimination Transfer - BG	.57*	.25	-.42*	-.54*	-.65*	-.37*	-.49*	-.32**
Concept Formation Learning - NBG	.30**	.28**	-.30**	-.24	-.25	-.27	-.35**	-.20
Concept Formation Learning - BG	.30**	.24	-.33**	-.30**	-.37*	-.26	.05	.02

* Significant at the .01 level.

** Significant at the .05 level.

NBG - No Background Interference Present.
BG - Background Interference Present.

TABLE XIV (Cont'd.)

INTERCORRELATIONS AMONG VISUAL LEARNING AND TRANSFER TASKS ONLY
NO BACKGROUND AND BACKGROUND

	Coding Proactive Inhibition - NBG	Coding Proactive Inhibition - BG	Discrimination Learning - NBG	Discrimination Learning - BG	Discrimination Transfer - NBG	Discrimination Transfer - BG	Concept Formation Learning - NBG	Concept Formation Learning - BG
Serial Learning Learning - NBG	-.27	-.45*	.41*	.49*	.45*	.57*	.30**	.30*
Serial Learning Learning - BG	-.09	-.38*	.23	.30**	.29**	.25	.28**	.24
Paired Associate Learning - NBG	.17	.35**	-.48*	-.49*	-.51*	-.42*	-.30**	-.33**
Paired Associate Learning - BG	.31**	.64*	-.47*	-.50*	-.54*	-.54*	-.24	-.30**
Paired Associate Transfer - NBG	.24	.52*	-.53*	-.63*	-.58*	-.65*	-.25	-.37*
Paired Associate Transfer - BG	.16	.45*	-.40*	-.37*	-.39*	-.37*	-.27	-.26
Coding Learning - NBG	.93*	.46*	-.39*	-.40*	-.50*	-.49*	-.35**	.05
Coding Learning - BG	.79*	.43*	-.23	-.25	-.31**	-.32**	-.20	.02
Coding, Proactive Inhibition - NBG		.53*	-.40*	-.40*	-.51*	-.50*	-.32**	.03
Coding, Proactive Inhibition - BG	.53*		-.62*	-.73*	-.74*	-.69*	-.11	-.39*
Discrimination Learning - NBG	-.40*	-.62*		.83*	.86*	.82*	.22	.17
Discrimination Learning - BG	-.40*	-.73*	.83*		.87*	.94*	.16	.32**
Discrimination Transfer - NBG	-.51*	-.74*	.86*	.87*		.86*	.18	.15
Discrimination Transfer - BG	-.50*	-.69*	.82*	.94*	.86*		.22	.17
Concept Formation Learning - NBG	-.32**	-.11	.22	.16	.18	.22		-.04
Concept Formation Learning - BG	.03	-.39*	.17	.32**	.15	.17	-.04	

* Significant at the .01 level.

** Significant at the .05 level.

NBG - No Background Interference Present.

BG - Background Interference Present.

at the .01 level and 3 significant at the .05 level. The significant correlations are also equally distributed among the learning tasks with background interference (7) and with no background interference (6). Serial Learning Learning with background interference correlated significantly with the other learning and transfer tasks 9 times - 6 at the .01 level and 3 at the .05 level. Again, these correlations were equally distributed among the learning tasks with background interference (4), and with no background interference (5). In general, the Serial Learning Recognition, Error, and Recall scores did not correlate significant with the learning and transfer scores whether the testing condition was with or with no background interference.

PAIRED ASSOCIATE LEARNING

Learning. Table XIV contains the Paired Associate Learning correlations with the other learning and transfer tasks. Paired Associate Learning, with no background interference, correlated significantly with the other learning tasks 12 out of a possible 15 times. Seven correlations were with tasks with background interference, 5 with tasks with no background interference. Paired Associate Learning with background interference correlated significantly 13 out of the 15 possibilities. Seven of the correlations were with learning tasks with no background interference and 6 with learning tasks with background interference.

Transfer. Table XIV. When the results of the Paired Associate transfer with no background interference was correlated with the 15 other learning and transfer tasks, it was found that 11 were significant, 7 with tasks with background interference and 4 with tasks with no background interference. There were 10 significant correlations of the Paired Associate task with background interference and the other learning and transfer tasks - 5 each with tasks with and with no background interference.

CODING LEARNING

Learning. Table XIV. Coding Learning with background interference and Concept Formation Learning with and with no background interference correlated significantly with the smallest number of the other learning and transfer tasks. Coding Learning with no background interference, correlated significantly with 10 of the other learning and transfer tasks. The correlations were equally distributed (5 and 5) with the learning and transfer tasks with and with no background interference. Coding Learning with background interference only correlated with 5 of the other learning and transfer tasks - 3 with no background interference and 2 with background interference.

Proactive Inhibition. Table XIV. The Proactive Inhibition analyses showed that the scores of the task with no background interference correlated significantly with 9 of the 15 other learning tasks - 4 with tasks with no background interference and 5 with the tasks with background interference. Fourteen out of the 15 correlations were significant among the Proactive Inhibition task with background interference and the other learning and transfer tasks. These correlations were equally distributed (7 and 7) between tasks with and with no background interference.

DISCRIMINATION LEARNING

Learning. Table XIV. Discrimination Learning with no background interference correlated significantly with the other learning and transfer tasks 11 times. The correlations were fairly equally distributed, 6 being with tasks with no background interference and 5 being with tasks with background interference. The Discrimination Learning task with background interference correlated significantly with 13 of the 15 other learning and transfer tasks. Seven of the correlations were with tasks with no background interference and 6 were with tasks with background interference.

Transfer. Table XIV. Thirteen statistically significant correlations were found for discrimination Learning Transfer with no background interference, and the other learning and transfer tasks. Six correlations were with tasks with no background interference and 7 were with tasks with background interference. A total of 12 significant correlations were found for Discrimination Learning Transfer with background interference and the other learning and transfer tasks. Seven of the correlations were with tasks with no background interference. Five of the correlations were with tasks with background interference.

The Discrimination Learning Error and Discrimination Learning Transfer Error scores correlated significantly with few of the learning and transfer scores other than those related to Discrimination Learning, Table XIII. Discrimination Learning Transfer Error (with and with no background interference) did show some significant relationship to Paired Associate Transfer.

CONCEPT FORMATION LEARNING

Only five of the other learning and transfer tasks correlated significantly with Concept Formation Learning with no background interference. Four of the correlations included tasks with no background interference and one with a task with background interference. Concept Formation Learning with background interference correlated significantly with 6 of the other learning and transfer tasks. The correlations were equally distributed (3 and 3) between tasks with and with no background interference.

LEARNING PERFORMANCE OF LOW (POOR) AND HIGH (GOOD) PERCEPTION GROUPS

Two sub-populations were selected from the original group of 49 subjects. These populations were composed of the 15 children having the lowest (least number of foreground responses) combined perceptual scores on the SVFBT and the SAFBT and the 15 children having the highest (greatest number of foreground

responses) combined perceptual scores. Table XV contains the comparative information regarding the two groups. There is a possible, maximum score of 36 that can be obtained on the two figure-background tests. The mean score for the Low group was 15.80 with a range from 7 to 18. The mean score for the High group was 24.07 with a range from 23 to 29. In regard to C.A., M.A., and I.Q., the High group was somewhat older chronologically and mentally than the Low group (over 12 month in C.A. and over 7 month in M.A.) but about 1.5 points lower in I.Q. These differences were not statistically significant.

The mean learning and transfer scores of these sub-groups were then compared.

SERIAL LEARNING

It was found that the Low (poor perception) group required more trials to learn the task both with and with no background interference than the High (good perception) group, Table XVI. The differences, however, were not statistically significant. While both the Low group and the High group learned the task with less trials under the condition of with background interference than with no background interference, the differences were again not significant.

TABLE XV
COMPARISONS OF CHRONOLOGICAL AGES, MENTAL AGES,
INTELLIGENCE QUOTIENTS, AND COMBINED SVFBT-SAFBT SCORES OF LOW (POOR)
AND HIGH (GOOD) PERCEPTION GROUPS
N = 15

	Low Group (Poor Perception)		High Group (Good Perception)		t
	Mean	Range	Mean	Range	
Combined SVFBT-SAFBT	15.80	7-18	24.07	23-29	
C.A.	116.30 months	94-148	128.87 months	87-155	1.78
M.A.	86.00 months	72-109	93.67 months	56-112	1.26
I.Q.	74.07	61-84	72.53	63-80	.62

TABLE XVI

COMPARISONS OF VISUAL SERIAL LEARNING PERFORMANCES
OF LOW (POOR) AND HIGH (GOOD) PERCEPTION GROUPS
NO BACKGROUND AND BACKGROUND

Mean	Low Group (Poor Perception)	
	No Background	Background
	<u>a</u> Learning	<u>b</u> Learning
	74.20	69.13
Mean	High Group (Good Perception)	
	No Background	Background
	<u>c</u> Learning	<u>d</u> Learning
	58.00	53.27

t Ratios

ac = 1.01

ab = .28

bd = .95

cd = .34

TABLE XVII

COMPARISONS OF VISUAL PAIRED ASSOCIATE LEARNING AND
TRANSFER PERFORMANCES OF LOW (POOR) AND HIGH (GOOD) PERCEPTION GROUPS
NO BACKGROUND AND BACKGROUND

Mean	Low Group (Poor Perception)			
	No Background		Background	
	<u>a</u> Learning	<u>b</u> Transfer	<u>c</u> Learning	<u>d</u> Transfer
	56.27	65.34	53.87	63.33
Mean	High Group (Good Perception)			
	No Background		Background	
	<u>e</u> Learning	<u>f</u> Transfer	<u>g</u> Learning	<u>h</u> Transfer
	66.93	76.00	59.87	73.47

t Ratios

ae = 1.32

ac = .26

ab = 1.08

bf = 1.24

bd = .19

cd = .86

cg = .60

eg = .79

ef = 1.10

dh = .98

fh = .30

gh = 1.42

PAIRED ASSOCIATE LEARNING AND TRANSFER

The Low (poor perception) and High (good perception) were compared for learning and transfer on a Paired Associate Task, Table XVII. While the Low group learned the task with less trials in every instance (learning, transfer, with background interference, and with no background interference) none of the differences were statistically significant. It was also found that fewer learning and fewer transfer trials were required by each group under the condition of with background interference than with no background interference. These differences, however, were also not significant.

CODING LEARNING AND PROACTIVE INHIBITION

The Low (poor perception) group scored slightly lower (completed fewer codings) than the High (good perception) group, Table XVIII. The differences were not statistically significant. Both the learning and the proactive inhibition scores were slightly lower under the condition with background interference than with no background interference, but not significantly so. Similarly, the proactive inhibition scores were slightly lower under the condition with background interference, but these differences were also not significant.

DISCRIMINATION LEARNING AND TRANSFER

In only one instance was the learning or transfer score of the Low (poor perception) and High (good perception) group significantly different, Table XIX. This was for transfer under the condition with no background interference and the High group required less time. Learning with background interference took slightly longer for both the Low and High groups but the difference from learning under the condition with no background interference was not significant. The only significantly lower (less time) transfer score than learning score was for the High group under the condition with no background interference.

TABLE XVIII

COMPARISONS OF VISUAL CODING LEARNING AND PROACTIVE INHIBITION PERFORMANCES OF LOW (POOR) AND HIGH (GOOD) PERCEPTION GROUPS. NO BACKGROUND AND BACKGROUND

Mean	Low Group (Poor Perception)			
	No Background		Background	
	<u>a</u> Learning	<u>b</u> Proactive Inhibition	<u>c</u> Learning	<u>d</u> Proactive Inhibition
	27.00	24.40	24.07	20.80
	High Group (Good Perception)			
	No Background		Background	
	<u>e</u> Learning	<u>f</u> Proactive Inhibition	<u>g</u> Learning	<u>h</u> Proactive Inhibition
	29.87	26.67	27.00	25.06

t Ratios

ae = .61
bf = .45
cg = .60
dh = 1.09

ac = .53
bd = .75
eg = .75
fh = .37

ab = .56
cd = .63
ef = .70
gh = .56

TABLE XIX

COMPARISONS OF VISUAL DISCRIMINATION LEARNING AND TRANSFER PERFORMANCES OF LOW (POOR) AND HIGH (GOOD) PERCEPTION GROUPS. NO BACKGROUND AND BACKGROUND

Mean	Low Group (Poor Perception)			
	No Background		Background	
	<u>a</u> Learning	<u>b</u> Transfer	<u>c</u> Learning	<u>d</u> Transfer
	211.18	206.8	220.09	222.16
	High Group (Good Perception)			
	No Background		Background	
	<u>e</u> Learning	<u>f</u> Transfer	<u>g</u> Learning	<u>h</u> Transfer
	186.11	175.60	192.43	187.38

t Ratios

ae = 1.34
bf = 2.05**
cg = 1.32
dh = 1.63

ac = .49
bd = .83
eg = .25
fh = .41

ab = .27
cd = .10
ef = 2.54*
gh = .35

* Significant at the .01 level.

** Significant at the .05 level.

CONCEPT FORMATION LEARNING AND TRANSFER

None of the differences between the learning scores for the Low (poor perception) and High (good perception) groups was statistically significant, Table XX. The High group had a significantly lower transfer score (performed the task with fewer trials) than the Low group under the condition with background interference (the Low group did better). In every instance, for both the Low and High groups, the transfer scores were significantly higher than the corresponding learning scores whether under the condition with no background interference or the condition with background interference.

It will be noted that in examining the summary table, Table XXI, that only one of the sixteen tests was significant at the .05 level - Discrimination Transfer with no background interference. By chance, it can be expected that one significant t at the .05 level will appear in twenty calculations.

CORRELATIONS AMONG DIAGNOSTIC AND ACHIEVEMENT TESTS

A number of additional or supplementary tests were administered to the subjects in an attempt to determine whether or not other instruments might be of greater diagnostic value in terms of their relationships to learning, transfer, and proactive inhibition than the original criteria tests used - the Syracuse Visual Figure-Background Test and the Syracuse Auditory Figure-Background Test. The results of these tests were correlated with the scores from the various learning task, and so forth. These tests were administered according to the instructions contained in the appropriate manuals. No improvised visual or auditory background interference condition was included. The results will be reported in two ways. The first will be the individual correlations obtained with C.A., M.A., I.Q., the Syracuse Visual Figure-Background Test, the Syracuse Auditory Figure-Background Test, and the Combined SVFBT-SAFBT scores. The second reporting will be in reference to the inter-correlations obtained with the learning tasks.

TABLE XX

COMPARISONS OF VISUAL CONCEPT FORMATION LEARNING AND TRANSFER
PERFORMANCES OF LOW (POOR) AND HIGH (GOOD) PERCEPTION GROUPS.
NO BACKGROUND AND BACKGROUND

Mean	Low Group (Poor Perception)			
	No Background		Background	
	<u>a</u> Learning	<u>b</u> Transfer	<u>c</u> Learning	<u>d</u> Transfer
	13.93	19.93	9.67	20.00
	High Group (Good Perception)			
	No Background		Background	
	<u>e</u> Learning	<u>f</u> Transfer	<u>g</u> Learning	<u>h</u> Transfer
	12.86	17.47	8.80	15.93

t Ratios

ae = .37

bf = 1.32

cg = .37

dh = 2.51*

ac = 1.52

bd = .03

eg = 1.68

fh = 1.58

ab = 2.26**

cd = 4.30*

ef = 2.19**

gh = 4.72*

* Significant at the .01 level.

** Significant at the .05 level.

TABLE XXI

SUMMARY OF MEAN LEARNING TASK SCORES (NO BACKGROUND AND BACKGROUND)
AND t RATIOS FOR LOW (POOR) AND HIGH (GOOD) PERCEPTION SUB-GROUPS

Learning and Transfer Tasks	Low Perception	High Perception	t
Serial Learning			
Learning - NBG	74.20	58.00	1.01
Serial Learning			
Learning - BG	69.13	53.27	.95
Paired Associate			
Learning - NBG	56.27	66.93	1.32
Paired Associate			
Learning - BG	53.87	59.87	.60
Paired Associate			
Transfer - NBG	65.34	76.00	1.24
Paired Associate			
Transfer - BG	63.33	73.47	.98
Coding			
Learning - NBG	27.00	29.87	.61
Coding			
Learning - BG	24.07	27.00	.60
Coding Proactive			
Inhibition - NBG	24.40	26.67	.45
Coding Proactive			
Inhibition - BG	20.80	25.06	1.09
Discrimination			
Learning - NBG	211.18	186.11	.87
Discrimination			
Learning - BG	220.09	192.43	1.32
Discrimination			
Transfer - NBG	206.80	175.60	2.05**
Discrimination			
Transfer - BG	222.16	187.38	1.63
Concept Formation			
Learning - NBG	13.93	12.86	.37
Concept Formation			
Learning - BG	9.67	8.80	.37

** Significant at the .05 level.

DEVELOPMENTAL TEST OF VISUAL PERCEPTION¹. (DTVP)

This test was still in the experimental stage when used but was included in the hope of discovering a correlation with other established tests as well as with the types of learning being studied. The DTVP is composed of 5 subtests which yield individual scores which can then be combined into a total score. Significant correlations with chronological age were obtained with three subtests plus the total score, Table XXII. The Eye-Motor Coordination subtest was correlated at the .05 level while Position in Space, Spatial Relation, and the total score were significant at the .01 level. Mental age was significantly correlated with 4 subtests plus the total score at the .01 level and with the Figure-Ground Disturbance subtest at the .05 level. Three subtests were significantly correlated with I.Q. at the .05 level. These were Eye-Motor Coordination, Constancy, and Spatial Relations. The total score was significantly correlated with I.Q. also at the .05 level. The SVFBT, the SAFBT nor the combined scores of the SVFBT-SAFBT were significantly correlated with any of the scores available from the DTVP.

TEST OF PRIMARY MENTAL ABILITIES (PMA)

The next test considered was the Primary Mental Abilities which includes 5 sub-tests plus an average sub-test score, Table XXIII. In terms of results, chronological age was significantly correlated with all the primary mental ability scores. Four of the sub-tests and the average score were significant at the .01 level. The fifth sub-test, "Numerical", was significantly correlated at the .05 level. When correlated with mental age, PMA "Numerical" significantly related at the .05 level, while the other sub-tests and the average score were significant at the .01 level of confidence. The PMA "Numerical" was significantly correlated with the SAFBT at the .05 level.

1. Marianne Frostig, Developmental Test of Visual Perception, Third Edition, 1961.

TABLE XXII

CORRELATIONS AMONG THE DIAGNOSTIC TESTS AND
DEVELOPMENTAL TEST OF VISUAL PERCEPTION

Developmental Test of Visual Perception	Diagnostic Tests					
	C.A.	M.A.	I.Q.	SVFBT	SAFBT	Combined SVFBT-SAFBT
Eye-Motor Coordination	.32**	.47*	.33**	.17	.08	.16
Figure-Ground Discrimination	.25	.32**	.15	.01	.01	.01
Constancy	.26	.38*	.29**	-.04	-.13	-.11
Position in Space	.41*	.44*	.11	.18	.04	.15
Spatial Relations	.41*	.57*	.35**	.13	-.15	-.01
Total Score	.47*	.62*	.34**	.13	-.03	.06

* Significant at the .01 level.

** Significant at the .05 level.

TABLE XXIII

CORRELATIONS AMONG THE DIAGNOSTIC TESTS AND
THE TEST OF PRIMARY MENTAL ABILITIES

Primary Mental Abilities	Diagnostic Tests					
	C.A.	M.A.	I.Q.	SVFBT	SAFBT	Combined SVFBT-SAFBT
Verbal	.52*	.51*	.23	.15	-.03	.07
Spatial	.46*	.52*	.26	.15	.08	.15
Reasoning	.45*	.61*	.41*	.10	-.02	.06
Perception	.47*	.50*	.12	.26	-.14	.08
Numerical	.28**	.36**	.22	.21	.31**	.27

* Significant at the .01 level.

** Significant at the .05 level.

THE ILLINOIS TEST OF PSYCHOLINGUISTIC ABILITY². (ITPA)

This is another test still in its experimental stages. The ITPA is composed of 9 sub-tests and a total score, Table XXIV. Chronological age was significantly correlated with 5 of the sub-tests and the total score at the .01 level and with two other sub-tests at the .05 level. Only "Motor Encoding" and "Visual Motor Association" did not correlate significantly with C.A. Of the ten possible correlations, mental age was significantly correlated at the .01 level with 7 of the sub-tests and the total score. Mental age was not significantly correlated with the "Visual-Motor Association" test. Mental age and "Motor Encoding" were correlated at the .05 level of confidence. The I.Q. was significantly correlated with 4 of the sub-test scores and with the total score. The correlations with "Auditory Vocal Association," "Visual Motor Association," and total score were at the .01 level of confidence and with "Auditory Vocal Automatic" and "Vocal Encoding" at the .05 level. SVFBT correlated significantly at the .05 level with "Visual Decoding", but failed to reach significance with any of the other scores available from the ITPA. The SAFBT was not significantly correlated with any scores derived from the ITPA. The combined scores of the SVFBT-SAFBT correlated with "Auditory Vocal Automatic" and "Auditory Decoding" at the .05 level.

BOTEL READING INVENTORY

The three tests of the Botel Reading Inventory were also correlated with chronological age, mental age, I.Q., the SVFBT, the SAFBT, and the combined SVFBT-SAFBT, Table XXV. "Word Opposites, Reading", and "Word Recognition" were significantly correlated with chronological age at the .01 level, "Word Opposites, Listening" was significantly correlated at the .05 level. All three tests of the Botel were significantly correlated at the .01 level with mental age. I.Q. was significantly correlated with "Word Opposites, Reading" and "Word Opposites,

2. James J. McCarthy and Samuel A. Kirk, The Illinois Test of Psycholinguistic Ability, Urbana, Illinois: Institute for Research on Exceptional Children, University of Illinois, 1961.

TABLE XXIV

CORRELATIONS AMONG THE DIAGNOSTIC TESTS AND THE
ILLINOIS TEST OF PSYCHOLINGUISTIC ABILITY

Illinois Test of Psycholinguistics	Diagnostic Tests					
	C.A.	M.A.	I.Q.	SVFBT	SAFBT	Combined SVFBT-SAFBT
Auditory Vocal Automatic	.60*	.67*	.29**	.27	.16	.28**
Visual Decoding	.35**	.39*	.19	.29**	-.02	.17
Motor Encoding	.26	.33**	.17	.09	-.10	-.01
Auditory Vocal Association	.62*	.77*	.48*	.15	.03	.12
Visual Motor Association	.30**	.39*	.39*	.07	-.05	.01
Vocal Encoding	.37*	.47*	.31**	.10	.07	.11
Auditory Vocal Sequencing	.48*	.54*	.19	-.02	-.04	-.04
Visual-Motor Association	.20	.26	.16	.08	-.10	-.01
Auditory Decoding	.38*	.44*	.25	-.22	-.24	-.30**
ITPA Total	.59*	.71*	.40*	.09	-.06	.02

* Significant at the .01 level.

** Significant at the .05 level.

TABLE XXV

CORRELATIONS AMONG THE DIAGNOSTIC TESTS AND THE
BOTEL READING INVENTORY

Botel Reading Inventory	Diagnostic Tests					Combined SVFBT-SAFBT
	C.A.	M.A.	I.Q.	SVFBT	SAFBT	
Word Opposites Reading	.50*	.60*	.31**	.06	.08	.09
Word Opposites Listening	.34**	.43*	.30**	-.001	.09	.06
Word Recognition	.60*	.59*	.20	.06	.05	.07

* Significant at the .01 level.

** Significant at the .05 level.

Listening" at the .05 level while "Word Recognition" was not significantly correlated with I.Q. The SVFBT, the SAFBT, nor the combined scores of the SVFBT-SAFBT were significantly correlated with any of the tests of the Botel.

The correlational results of the achievement and diagnostic tests seem to follow the same patterns evidenced by the correlations of the Learning tasks with chronological age, mental age, I.Q., the SVFBT, the SAFBT, and the combined SVFBT-SAFBT. Mental age appears to be more significantly correlated with the diagnostic and achievement test scores than do the other variables. In reference to the general hypothesis of this study, a visual or auditory perceptual factor appears to have little relationship with achievement test scores or with other tests designed to measure perception.

CORRELATIONS AMONG THE LEARNING AND TRANSFER TASKS AND THE DIAGNOSTIC ACHIEVEMENT TESTS

DEVELOPMENTAL TEST OF VISUAL PERCEPTION

Serial Learning. Twelve correlations were calculated for Serial Learning (with and with no background interference) and the five sub-tests and total score of the Developmental Test of Visual Perception, Table XXVI. Only three of the correlations were significant - two at the .05 level of confidence and one at the .01 level. Sub-test "Position in Space" was correlated significantly at the .01 level. Sub-test "Spatial Relations" and the total score were correlated with Serial Learning at the .05 level. These correlations were all with Serial Learning with no background interference.

Paired Associate Learning and Transfer. Of the twenty-four correlation calculated with the sub-tests and total score, only six were significant, at the .05 level and 2 at the .01 level. "Spatial Relations" correlated significantly with Paired Associate Learning and Transfer (with and with no background disturbance). The total score correlated with the learning and transfer score only when the condition was with no background interference.

TABLE XXVI
CORRELATIONS AMONG THE LEARNING AND TRANSFER TASKS
(NO BACKGROUND AND BACKGROUND)
AND THE DEVELOPMENTAL TEST OF VISUAL PERCEPTION

Learning and Transfer Tasks	Developmental Test of Visual Perception					
	Eye-Motor Coordination	Figure-Ground Discrimination	Constancy	Position in Space	Spatial Relations	Total Score
Serial Learning Learning - NBG	-.21	.001	-.21	-.43	-.32**	-.33**
Serial Learning Learning - BG	-.02	.07	-.03	-.17	-.22	-.11
Paired Associate Learning - NBG	.27	.24	.24	.16	.32**	.35**
Paired Associate Transfer - BG	.14	.01	.07	.14	.39*	.21
Coding Learning - NBG	.22	-.04	.17	.34**	.29**	.28*
Coding Learning - BG	.15	-.03	.08	.20	.11	.15
Coding Proactive Inhibition - NBG	.29**	.03	.28**	.37*	.39*	.39*
Coding Proactive Inhibition - BG	.44*	.25	.39*	.51*	.52*	.60*
Discrimination Learning - NBG	-.39*	-.34**	-.25	-.38*	-.46*	-.51*
Discrimination Learning - BG	-.51	-.33**	-.39*	-.45*	-.46*	-.61*
Discrimination Transfer - NBG	-.49*	-.39*	-.37*	-.47*	-.47*	-.63*
Discrimination Transfer - BG	-.45*	-.25	-.33**	-.44*	-.42*	-.54*
Concept Formation Learning - NBG	-.07	.07	-.27	-.30**	-.22	-.26
Concept Formation Learning - BG	-.13	-.05	-.21	-.09	-.29**	-.21

* Significant at the .01 level.

** Significant at the .05 level.

Coding Learning and Proactive Inhibition. Coding Learning with no background interference correlated significantly with "Position in Space" (.05 level), "Spatial Relations" (.05 level), and the total score (.01 level). Coding Learning with background interference correlated significantly with none of the sub-tests nor the total score. Coding, Proactive Inhibition, and four of the five sub-tests and the total score of the Developmental Test of Visual Perception correlated significantly. Eight of the 10 correlations were significant at the .01 level. Only "Figure-Ground Discrimination" failed to correlate significantly with Coding, Proactive Inhibition with and with no background interference.

Discrimination Learning and Transfer. Twenty-four correlations were calculated. Of these, nineteen were significant at the .01 level and 3 were significant at the .05 level. "Constancy" failed to correlate significantly with Discrimination Learning with no background interference and "Figure-Ground Discrimination" with Discrimination Transfer with background interference.

Concept Formation Learning. Only two significant correlations (at the .05 level) were found for Concept Formation Learning out of the 12 calculated. "Position in Space" with Concept Formation Learning with no background interference and "Spatial Relations" with Concept Formation Learning with background interference were the two.

TEST OF PRIMARY MENTAL ABILITIES

Serial Learning. Of the twelve correlations calculated for Serial Learning and the 5 sub-tests and the total score of the Test of Primary Mental Abilities, 11 were significant, 7 at the .01 level and 4 at the .05 level, Table XXVII. "Perception" and Serial Learning Learning with background interference did not correlate significantly.

Paired Associates Learning and Transfer. Every one of the twenty-four correlations calculated were significant. Eighteen of the correlations were significant at the .01 level and 6 at the .05 level.

Coding Learning and Proactive Inhibition. Coding Learning with no background interference correlated significantly (at the .01 level) with "Perception" and the total score - two out of six. Coding Learning with background disturbance only correlated significantly (at the .05 level) with "Perception". Coding, Proactive Inhibition with no background interference correlated significantly (at the .01 level) with "Perception" and the total score. All of the sub-tests as well as the total score of the Test of Primary Mental Abilities correlated significantly (at the .01 level) with Coding, Proactive Inhibition with background interference.

Discrimination Learning and Transfer. Every correlation calculated (24) with Discrimination Learning and Transfer and the sub-tests and the total score of the Test of Primary Mental Abilities was significant, twenty-three at the .01 level of confidence and 1 at the .05 level.

Concept Formation Learning. Only four of the twelve correlations were significant. These were Concept Formation Learning with background interference and "Spatial" (.01 level), "Reasoning" (.01 level), "Numerical" (.05 level), and the total score (.01 level).

THE ILLINOIS TEST OF PSYCHOLINGUISTIC ABILITY

Serial Learning. Twenty correlations were calculated, 8 were significant, Table XXVIII. Serial Learning with no background interference correlated significantly with "Auditory Vocal Automatic" (.01 level), "Auditory Vocal Association" (.05 level), "Auditory Vocal Sequential" (.01 level), "Auditory Decoding" (.05 level), and the total score (.01 level). Serial Learning with background interference correlated significantly with "Auditory Vocal Automatic" (.05 level), "Auditory Vocal Sequential" (.01 level), and the total score (.05 level).

Paired Associate Learning and Transfer. Forty correlations were calculated of which 24 were significant. "Visual Decoding" and "Motor Encoding" appeared

TABLE XXVII

CORRELATIONS AMONG THE LEARNING AND TRANSFER TASKS
(NO BACKGROUND AND BACKGROUND)
AND THE TEST OF PRIMARY MENTAL ABILITIES

Learning and Transfer Tasks	Primary Mental Abilities					
	Verbal	Spatial	Reasoning	Perception	Numerical	Total
Serial Learning Learning - NBG	-.37*	-.46*	-.50*	-.28**	-.36**	-.50*
Serial Learning Learning - BG	-.50*	-.41*	-.35**	-.07	-.31**	-.39*
Paired Associates Learning - NBG	.54*	.42*	.49*	.32**	.28**	.55*
Paired Associates Learning - BG	.53*	.34**	.54*	.42*	.46*	.64*
Paired Associates Transfer - NBG	.55*	.43*	.62*	.33**	.41*	.61*
Paired Associates Transfer - BG	.51*	.48*	.48*	.28**	.32**	.54*
Coding Learning - NBG	.27	.07	.05	.45*	-.02	.34*
Coding Learning - BG	.14	-.06	-.04	.33**	-.05	.27
Coding Proactive Inhibition - NBG	.22	.16	.10	.51*	.04	.41*
Coding Proactive Inhibition - BG	.50*	.52*	.76*	.63*	.60*	.82*
Discrimination Learning - NBG	-.52*	-.43*	-.58*	-.64*	-.34**	-.72*
Discrimination Learning - BG	-.47*	-.56*	-.68*	-.57*	-.44*	-.76*
Discrimination Transfer - NBG	-.52*	-.48*	-.63*	-.62*	-.47*	-.76*
Discrimination Transfer - BG	-.44*	-.46*	-.60*	-.59*	-.40*	-.71*
Concept Formation Learning - NBG	-.10	-.19	-.07	-.18	-.05	-.19
Concept Formation Learning - BG	-.22	-.41*	-.47*	-.20	-.33**	-.42*

* Significant at the .01 level.

** Significant at the .05 level.

TABLE XXVIII

CORRELATIONS AMONG THE LEARNING AND TRANSFER TASKS
(NO BACKGROUND AND BACKGROUND)
AND THE ILLINOIS TEST OF PSYCHOLINGUISTIC ABILITY

Learning and Transfer Tasks	Illinois Test of Psycho-linguistics Ability									
	Auditory Vocal Automatic	Visual Decoding	Motor Encoding	Auditory Vocal Association	Visual Motor Association	Vocal Encoding	Auditory Vocal Sequencing	Visual Motor Association	Auditory Decoding	Total Score
Serial Learning										
Learning - NBG	-.41*	-.27	-.11	-.33**	-.18	-.23	-.56*	-.16	-.33**	-.46
Serial Learning										
Learning - BG	-.35**	-.08	.03	-.26	-.14	-.14	-.39*	.01	-.24	-.29*
Paired Associates										
Learning - NBG	.32**	.19	.09	.37*	.23	.32**	.29**	.01	.31**	.38*
Paired Associates										
Learning - BG	.60*	.14	.10	.52*	.28**	.24	.40*	.34**	.26	.48*
Paired Associates										
Transfer - NBG	.43*	.22	.07	.46*	.32**	.40*	.38*	.16	.38*	.49*
Paired Associates										
Transfer - BG	.48*	.19	.12	.47*	.18	.25	.33	.28**	.29**	.43*
Coding Learning										
- NBG	.32**	.32**	.10	.21	.14	.12	.22	.19	.05	.27
Coding Learning										
- BG	.26	.05	.07	.15	.08	.01	.14	.15	-.08	.12
Coding, Proactive										
Inhibition - NBG	.29**	.36**	.09	.26	.14	.15	.23	.23	.06	.28*
Coding, Proactive										
Inhibition - BG	.55*	.19	.11	.67*	.46*	.35**	.51*	.37*	.36**	.61*
Discrimination										
Learning - NBG	-.45*	-.38*	-.21	-.65*	-.52*	-.32**	-.61*	-.41*	-.65*	-.72*
Discrimination										
Learning - BG	-.59*	-.44*	-.24	-.69*	-.50*	-.45*	-.52*	-.38*	-.56*	-.74*
Discrimination										
Transfer - NBG	-.50*	-.40*	-.10	-.65*	-.46*	-.37*	-.47*	-.33*	-.47*	-.64*
Discrimination										
Transfer - BG	-.58*	-.50*	-.20	-.59*	-.43*	-.38*	-.49*	-.46*	-.45*	-.68*
Concept Formation										
Learning - NBG	-.27	-.33**	-.14	-.13	.03	-.24	-.37*	-.20	-.16	-.29*
Concept Formation										
Learning - BG	-.29**	-.07	-.23	-.38*	-.21	-.10	-.27	.005	-.24	-.31*

* Significant at the .01 level. ** Significant at the .05 level.

to have little or no relationship to the Paired Associate tasks.

Coding Learning and Proactive Inhibition. The Coding tasks appeared to have little relationship with any of the sub-tests or the total score of the Illinois Test of Psycholinguistic Ability with the exception of Coding, Proactive Inhibition with background interference. Here eight of the 10 correlations were significant. Excepted were "Visual Decoding" and "Motor Encoding".

Discrimination Learning and Transfer. Every sub-test and the total score of the Illinois Test of Psycholinguistic Ability and Discrimination Learning and Transfer with and with no background interference correlated significantly with the exception of "Motor Encoding". Thirty-four of the correlations were significant at the .01 level of confidence, two at the .05 level.

Concept Formation Learning. Concept Formation Learning with and with no background interference correlated significantly (at the .05 level) with the total score. Only four other significant correlations were found, two at the .01 level of confidence and two at the .05 level.

BOTEL READING INVENTORY

Serial Learning. The six correlations calculated were all significant, four at the .01 level of confidence ("Word Opposites, Reading" and "Word Recognition") and two at the .05 level ("Word Opposites, Listening"), Table XXIX.

Paired Associate Learning and Transfer. Again, all (12) of the correlations were significant, ten at the .01 level of confidence, 2 at the .05 level.

Coding Learning and Proactive Inhibition. Coding Learning with no background interference correlated with each of the sub-tests significantly, at the .05 level of confidence. Coding Learning with background interference correlated only with "Word Recognition" significantly at the .05 level. Coding, Proactive Inhibition with no background interference correlated significantly (at the .05 level) with "Word Opposites, Listening" and "Word Recognition". Coding, Proactive Inhibition correlated significantly (at the .01 level) with each of the sub-tests.

Discrimination Learning and Transfer. "Word Opposites, Reading" and "Word Recognition" correlated significantly (at the .01 level) with the Discrimination Learning tasks. "Word Opposites, Listening" correlated significantly (at the .01 level) only with Discrimination Transfer with no background interference.

Concept Formation Learning. The sub-tests of the Botel Reading Inventory did not correlate significantly with Concept Formation Learning with no background interference. They did, however, correlate significantly (at the .05 level of confidence) with Concept Formation Learning with background interference.

COMPARISON OF LEARNING TASK PERFORMANCE NO BACKGROUND AND BACKGROUND

In order to determine whether or not there was a difference in the subjects' performance on the visual learning tasks with no background interference and with background interference, a series of t tests were run. The total group had originally been randomly divided so that one half received the learning task with background interference on the first testing and the other half did not.

When equated forms of the tests were readministered, the groups were reversed. Those who had taken the tests with background interference now received them with no background interference and vice versa. This was done to negate any possible learning factor that might influence the test results on the second administration and thus becloud the data for examination of any possible influence of background interference.

The mean Serial Learning score under the condition of no background interference was 61.82 trials as compared to a score of 61.58 trials under the condition of background interference, Table XXX. The t of .003 is not significant. It will also be noted that the means under the conditions with and with no background interference for Paired Associate Learning, Paired Associate Transfer, Coding Learning, Coding Proactive Inhibition, Discrimination Learning, Discrimination Transfer, and Concept Formation Learning are very similar and that none of the t ratios approach significance.

TABLE XXIX
CORRELATIONS AMONG THE LEARNING AND TRANSFER TASKS
(NO BACKGROUND AND BACKGROUND)
AND THE BOTEL READING INVENTORY

Learning and Transfer Tasks	Botel Reading Inventory		
	Word Opposites Reading	Word Opposites Listening	Word Recognition
Serial Learning			
Learning - NBG	-.49*	-.36**	-.63*
Serial Learning			
Learning - BG	-.41*	-.35**	-.64*
Paired Associates			
Learning - NBG	.38*	.42*	.44*
Paired Associates			
Learning - BG	.41*	.34**	.62*
Paired Associates			
Transfer - NBG	.37*	.28**	.54*
Paired Associates			
Transfer - BG	.40*	.39*	.61*
Coding			
Learning - NBG	.30**	.34**	.32**
Coding			
Learning - BG	.27	.17	.28**
Coding Proactive			
Inhibition - NBG	.24	.36**	.29**
Coding Proactive			
Inhibition - BG	.57*	.46*	.62*
Discrimination			
Learning - NBG	-.51*	-.26	-.50*
Discrimination			
Learning - BG	-.45*	-.24	-.46*
Discrimination			
Transfer - NBG	-.42*	-.37*	-.52*
Discrimination			
Transfer - BG	-.37*	-.18	-.44*
Concept Formation			
Learning - NBG	-.14	-.26	-.13
Concept Formation			
Learning - BG	-.33*	-.31**	-.28**

* Significant at the .01 level.

** Significant at the .05 level.

TABLE XXX

MEAN LEARNING TASK SCORES AND t RATIOS UNDER
CONDITIONS OF WITH NO BACKGROUND INTERFERENCE AND
WITH BACKGROUND INTERFERENCE

Learning Task	No Background	Background	t
Serial Learning	61.82	61.54	.003
Paired Associate Learning	61.22	58.39	.56
Paired Associate Transfer	70.16	69.69	.09
Coding Learning	28.90	26.12	1.24
Coding Proactive Inhibition	25.80	22.56	1.35
Discrimination Learning	197.13	205.98	.84
Discrimination Transfer	190.59	199.57	.92
Concept Formation Learning	11.63	10.14	1.04

CHAPTER V
SUMMARY AND DISCUSSION

A review of the research of children with perceptual (figure-background) disorders and without perceptual disorders, indicated a need for investigating the possible relationships between such disorders and learning.

A statistical investigation was made of the results of tests and visual learning tasks administered to 49 children with varying degrees of auditory and visual perceptual disorders. Auditory and visual-auditory learning tasks were administered to 28 of these same children selected randomly from the original group. The data was analyzed by the use of the t test and intercorrelations. The 49 children ranged in C.A. from 87 to 155 months with a mean of 126.63. Mental age range was 56 to 121 months with a mean of 92.99. Of a possible 16 points, the scores on the SVFBT ranged from 4 to 13 with a mean of 8.36. Total possible score on the SAFBT was 20 with subjects ranging from 5 to 15 with a mean of 11.77

The sample of 28 children selected from the original population of 49 had a mean C.A. of 144.21 months with a range from 108 to 177. Their mean M.A. was 105.29 months with a range from 67 to 139 and a mean I.Q. of 72.93 with a range from 62 to 84. The mean scores on the SVFBT and SAFBT were 8.54 and 11.82 respectively with ranges of 4 to 13 and 1 to 16.

While most of the research conducted in the area of perceptual disorders that have failed to demonstrate differences in learning or amount of skill and knowledge acquired have been conducted with older children, there appears to be some evidence that the phenomenon of perceptual disability is more severe and has greater impact upon younger children. As a result, young mentally retarded children (mean C.A. of 10-6) with sufficient mental age (mean M.A. of 7-9) to perform the learning tasks were initially selected. The sample of 28 children

was somewhat older (18 months chronologically and 12 months mentally) since the auditory and visual-auditory testing was done a year and one-half after the visual testing.

The subjects were randomly divided into two groups for the administration of the learning tasks. Group I initially received a battery of learning tasks with a minimum of auditory and visual background interference, and Group II initially received a battery of learning tasks with added, controlled visual and auditory background interference. The visual learning tasks administered were the following: Serial Learning; Paired Associate Learning and Transfer; Concept Formation Learning; Discrimination Learning and Transfer; and Coding Learning and Proactive Inhibition. The auditory learning tasks administered were the following: Serial Learning and Paired Associate Learning. The visual-auditory task administered was Paired Associate Learning.

After a period of from 6 weeks to 2 months following the end of the first series of tests, the testing program was reversed, i.e., group 1 received the tasks with added controlled visual and auditory background interference and Group 2 with no background interference. The second administration of the learning tasks consisted of different, equated forms. In this way it was anticipated that when the entire group was compared correlationally, learning carryover from one task to the next would be negated and differences that appeared could be attributed to the presence or absence of the background interference, rather than due to residual learning.

Hypothesis No. 3 states: There are no significant differences between the results obtained on the learning tasks in a situation containing a minimum of visual and auditory background interference and the results obtained on the learning tasks in a situation of controlled visual and auditory background interference.

As the results indicate, this hypothesis was supported. Scores obtained from the learning tasks without a background disturbance did not differ significantly from the scores on the learning tasks with a background present. In other words, the presence of a background disturbance did not seem to interfere with the learning process. Since the children manifested varying degrees of perceptual disorder but the amount of learning that took place did not vary significantly, the implication is that the learning skills studied are not effected by visual and auditory distractors either in the individual or in the learning task.

Hypotheses 1 and 2 are: There is no significant correlation between visual and auditory perceptual ability as measured by the tests employed and learning performance in a situation containing a minimum of visual and auditory background interference; and there is no significant correlation between visual and auditory perceptual ability as measured by the tests employed and learning performance in a situation of controlled extraneous auditory and visual background interference. These hypotheses were also supported by the data. Only one significant correlation (at the .05 level) with the auditory and auditory-visual learning tasks. One correlation, significant at this level, can be anticipated out of every 20 by chance. In this instance, the single correlations were actually obtained once in 16--hardly better than probability would predict.

The conclusion to be drawn from this study is in support of the evidence against perceptual disorders creating interference in learning. The contention that a perceptual figure ground disturbance necessarily interferes with the learning process is not supported by the evidence resulting from this study.

A generalization which can be drawn from this study comes from the learning task with background disturbance present. The variances in these cases were somewhat greater than in the tasks without no background interference, often as much as twice as great. Only in Concept Formation this did not hold true. The

background interference seems to affect some children more than others. Explanation of this phenomenon cannot be derived from the available data. It is, however, certainly worthy of investigation. The answer does not appear to lie in the mere presence, absence, or degree of figure-background disturbance.

Rather than the presence or absence of a perceptual disorder being used as a predictor for learning success, the weight of evidence obtained favors mental age. In 33 correlations obtained, mental age was significantly correlated with 23, 15 at the .01 level of confidence and 8 at the .05 level of confidence.

Chronological age was significantly correlated with 20 of the 33 variables. Six at the .05 level and 14 at the .01 level. This follows the trend exhibited by mental age. The I.Q. score appears to be of less value as only 12 significant correlations appeared, only 2 of which were at the .01 level.

Restated, the mental age appears to be of more value in predicting learning successes than does either the chronological age or the I.Q. or the presence or absence of perceptual disorders.

A further implication can be derived from the results of this study. This information is derived from test intercorrelations. The Test of Primary Mental Abilities score was correlated with the Wechsler Intelligence Scale for Children score at .37 which is significant at the .01 level of confidence. However, the WISC was significantly correlated only 25 times with the other 58 variables. Only 7 of these correlations were significant at the .01 level. The others were significant at the .05 level. On the other hand, 45 significant correlations appeared among the variables and the PMA, 37 at the .01 level and 8 at the .05 level. The implications derived here is that the PMA is a more accurate predictor of learning skills than the I.Q. from the WISC. There definitely are more variables that have to be considered, but the PMA seems to be of more value for predicting learning, transfer, recall, and error success as measured by these tasks.

As the results show, the perceptual disorder or inability to distinguish a figure from its ground as measured by the Syracuse Visual Figure-Background Test and Syracuse Auditory Figure-Background Test, is not necessarily indicative of a learning problem. The consistency of the results adds to the weight of this evidence. Certain degrees of caution, however, are involved in the generalization of these results. Age and mental functioning of the sample is necessarily limited to range. In addition, the tasks used certainly were not comprehensive and failed to sample many kinds of learning.

Two unique aspects of the present study were (1) the inclusion of an auditory figure-background test for selection purposes and (2) two auditory learning tests and one visual-auditory learning test. The results of these tests supported the findings of the visual learning tests. Again, no relationship could be found between learning and visual and/or auditory perceptual disability under learning conditions of with no background interference or with background interference.

REFERENCES

Books

- Cruickshank, W. M., et al. A Teaching Method for Brain-Injured and Hyperactive Children. Syracuse: Syracuse University Press, 1961.
- Cruickshank, W. M., Bice, Harry V., and Wallen, Norman E. Perception and Cerebral Palsy. Syracuse: Syracuse University Press, 1957.
- Edwards, Allen L. Experimental Design in Psychological Research. New York: Rinehard and Company, Inc., 1951.
- Hollingworth, L. S. The Psychology of Subnormal Children. New York: The Macmillan Company, 1920.
- Johnson, G. O. and Blake, Kathryn A. Learning Performance of Retarded and Normal Children. Syracuse: Syracuse University Press, 1960.
- Kirk, Sam A. Teaching Reading to Slow Learning Children. Boston: Houghton Mifflin Company, 1940.
- Strauss, A. A., and Lehtinen, Laura E. Psychopathology and Education of the Brain-Injured Child. New York: Grune and Stratton, 1947.
- Woodworth, R. S., and Schlosberg, H. Experimental Psychology 2nd ed. New York: Henry Holt and Company, 1956.

Articles and Periodicals

- Bensberg, G. J. "The Relationship of Academic Achievement of Mental Defectives to Mental Age, Sex, Institutionalization, and Etiology," American Journal of Mental Deficiency, LVII (1953), 327-330.
- Bijou, S. W. "The Special Problem of Motivation in the Academic Learning of the Retarded Child," Exceptional Children, XIX (1952), 103-104.
- Capobianco, R. J. "Quantitative and Qualitative Analyses of Endogenous and Exogenous Boys on Arithmetic Achievement," Monograph of Social Research in Child Development, XIX (1956), 101-141.
- Doehring, G., and Reitan, R. M. "Concept Attainment of Human Adults with Lateralized Cerebral Lesions," Perceptual and Motor Skills, XIV (1962), 27-33.
- Gallagher, J. J. "A Comparison of Brain-Injured and Non-Brain-Injured Mentally Retarded Children on Several Psychological Variables," Monograph of Social Research in Child Development, XXII (1957), 1-79.
- Halpin, Virginia, and Patterson, Ruth. "The Performance of Brain-Injured Children on the Goldstein-Scheerer Tests," American Journal of Mental Deficiency, LIX (1954), 91-99.

- Hilgard, E. R., Irvine, R. T., and Whipple, J. E. "Rote Memorization, Understanding and Transfer: An Extension of Katona's Card-Trick Experiments," Journal of Experimental Psychology, XLVI (1953), 288-292.
- Long, L., and Welch, L. "Influence of Levels of Abstractness on Reasoning Ability," Journal of Psychology, XIII (1942), 41-59.
- Matthews, Charles G., and Reitan, R. M. "Comparisons of Abstraction Ability in Retardates and in Patients with Cerebral Lesions," Perceptual and Motor Skills, XII (1961), 327-333.
- McMurray, J. G. "Rigidity in Conceptual Thinking in Exogenous and Endogenous Mentally Retarded Children," Journal of Consulting Psychology, XVII (1954), 366-370.
- Merrill, M. A. "On the Relation of Intelligence of Achievement in the Case of Mentally Retarded Children," Comparative Psychology Monographs II, (1942).
- Neely, James H., A Study of the Relationship of Figure Background Difficulty and School Achievement in Cerebral Palsied Children, Syracuse University, Unpublished Doctoral Dissertation, 1958, 82.
- Robertson, J. P. S. "Age, Vocabulary, Anxiety, and Brain Damage as Factors in Verbal Learning," Journal of Consulting Psychology, XXI (1957), 170-182.
- Sloan, W., and Berg, I.A. "A Comparison of Two Types of Learning in Mental Defectives," American Journal of Mental Deficiency, LXI (1957), 556-566.
- Strauss, A. A., and Werner, H. "Disorders of Conceptual Thinking in the Brain-Injured Child," Journal of Nervous and Mental Diseases, XCVI (1942), 153-172.
- Thompson, C. W., and Margaret, G. A. "Differential Test Responses of Normals and Mental Defectives," Journal of Abnormal and Social Research, XLII (1947), 285-293.
- Werner, H., and Carrison, Doris. "Animistic Thinking in Brain-Injured Mentally Retarded Children," Journal of Abnormal and Social Psychology, XXXIX (1944), 38-45.
- Woodrow, H. "Practice and Transference in Normal and Feeble-minded Children," Journal of Educational Psychology, VIII (1917), 85-96, 151-165.
- Zigler, Edward, "An Overview of Research in Learning, Motivation, and Perception," Exceptional Children, XXVIII (1962), 455-458.

Unpublished Material

Miller, Donald Y. "Quantitative and Qualitative Analyses of Exogenous and Endogenous Children in Some Reading Processes," Unpublished Doctoral Dissertation, Syracuse University, 1958.

Other Sources

AO School Vision Test (Massachusetts Vision Test) Manual (A), Prepared by Hollis Leverett and Evelyn Backer. American Optical Company, 1955.

APPENDIX A

SERIAL LEARNING

The non-sense syllables used in this task were as follows as they were set on the memory drum.

First Testing Period

bup

yek

mib

tev

pim

Second Testing Period

tok

fen

bim

zop

vad

APPENDIX B
PAIRED ASSOCIATE LEARNING

Lists of non-sense syllables as they were prepared for placement
on the memory drum.

Learning Series

bip juf
bip
kej pob
kej
zab rix
zab

kej
kej pob
zab
zab rix
bip
bip juf

zab rix
zab
bip juf
bip
kej pob
kej

zab rix
zab
kej pob
kej
bip juf
bip

Transfer Series

kaj pob
kaj
zub rix
zub
bep juf
bep

kaj pob
kaj
bep juf
bep
zub rix
zub

zub rix
zub
bep juf
bep
kaj pob
kaj

bep juf
bep
kaj pob
kaj
zub rix
zub

I	II	III	IV	V	VI
1. MA3	MUP	FEN	KAY	PAV	LEP
2. LUK	PEB	NAF	YEV	YEF	TIV
3. MIB	FUT	BEP	SIB	MOP	YAF
4. YEL	YEL	NIF	TEK	BAF	VET
5. JAP	NID	TUV	DIN	PIM	KIN
6. BIM	PUB	NAB	TUY	WEB	TEP
7. FAD	BEP	TCK	YEK	PIV	VIT
8. MIF	NAL	PAF	CAD	VAD	MEV
9. LAN	TED	YIM	KEY	BIM	YIN
10. PED	BUF	FAN	YUK	ZAK	BAP
11. YIR	JET	PEO	FID	BOF	TEV
12. PEV	DUP	VIK	HUP	MIP	ZCP

NAME _____ DATE _____ TEST # _____ EXAMINER _____

1.	NAR	MUP	FEN	IV	V	VI
2.	LUK	PEB	NAF	YEV	PAM	LEP
3.	WIB	FUT	BER	SIB	BEF	TIV
4.	YEL	YEL	NIF	TEK	MCP	XAF
5.	DAP	MID	TUV	DIN	ZAF	VET
6.	BIN	PUB	NAB	TUY	PIM	XIN
7.	FAD	BER	TOK	YEK	VEB	TEP
8.	MAF	NAL	PAF	CAD	PIV	VIT
9.	LAM	TED	YIM	KEY	VAD	MEV
10.	PEO	BUF	FAN	YUK	BIM	YIN
11.	YIB	JET	PEB	FID	ZAK	BAP
12.	BEM	BUP	VIX	HUP	BOF	TEV
					MIF	ZOP

NAME _____ DATE _____ TEST # _____ EXAMINER _____

RETROACTIVE INHIBITION

1	2	3	4	5	6	7	8	9
T	V	÷	-	÷	+	(	7	)

2	1	4	6	3	5	2	1	8	4	2	1	3	1	2	3	1	1	2	6	3	1	3	5	1

3	1	5	4	2	7	4	6	9	2	5	8	4	7	6	1	8	7	5	4	8	6	9	4	3

1	8	2	9	7	6	2	5	4	7	3	6	8	5	9	4	1	6	8	9	3	7	5	1	4

9	1	5	8	7	6	9	7	8	2	4	8	3	5	6	7	1	9	4	3	6	2	7	9	3

NAME _____ DATE _____ TEST # _____ EXAMINER _____

PROACTIVE INHIBITION

1	2	3	4	5	6	7	8	9
H	V	÷	H	+	+	7	7	7

2	1	4	6	3	5	2	1	3	4	2	1	3	1	2	3	1	4	2	6	3	1	3	5	1
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

3	1	5	4	2	7	4	6	9	2	5	8	4	7	6	1	8	7	5	4	8	6	9	4	3
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

1	8	9	2	7	6	2	5	4	7	3	6	8	5	9	4	1	6	8	9	3	7	5	1	4
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

9	1	5	8	7	6	9	7	8	2	4	8	3	5	6	7	1	9	4	3	6	2	7	9	3
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

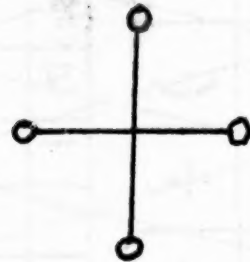
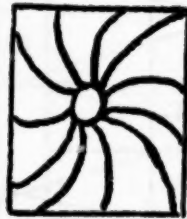
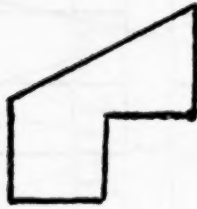
APPENDIX D

DISCRIMINATION LEARNING

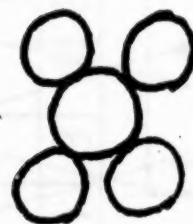
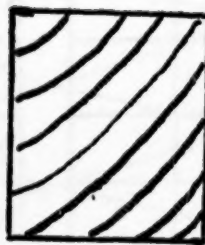
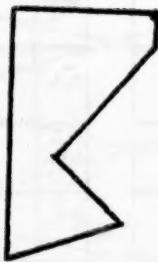
Card Sorting

Designs employed in the learning and transfer series of the card sorting task.

Learning Series



Transfer Series



APPENDIX E

CONCEPT FORMATION LEARNING

GEOMETRIC FORMS		LIGHT
A	B	ON
B	C	OFF
C	A	ON
	?	OFF

A	B	C
---	---	---

I	II	III	IV	V	VI
○	☾	≡	⋈	◐	▢▴▾
□	⬡	△	▴	⊕	⊗
△	▴▾	▢	⊕	▢	〰

PRINCIPLE TASK
LEARNING SERIES

BACKGROUND
DISTURBANCE

NAME _____
DATE _____
EXAMINER _____
SCHOOL _____

ALL TASKS FOR LEARNING SERIES USE BLOCKS I

Trial 1 CA on
AB on Tries 1 2 3
BC off Principle R W
A B C

Trial 2 CB on
AC off Tries 1 2 3
BA on Principle R W
A B C

Trial 3 AB off
BC on Tries 1 2 3
CA on Principle R W
B C A

Trial 4 BC on
CA off Tries 1 2 3
AB on Principle R W
B A C

Trial 5 BA on
CB off Tries 1 2 3
AC on Principle R W
C A B

Trial 6 AC on
BA off Tries 1 2 3
CB on Principle R W
C B A

Trial 7 BA off
CB on Tries 1 2 3
AC on Principle R W
B C A

Trial 8 CB off
AC on Tries 1 2 3
BA on Principle R W
C A B

Trial 9 AC off
BA on Tries 1 2 3
CB on Principle R W
A B C

Trial 10 AC on
BA on Tries 1 2 3
CB off Principle
C B A

Trial 11 BC on
CA on Tries 1 2 3
AB off Principle R W
A B C

Trial 12 CA off
AB on Tries 1 2 3
BC on Principle R W
B A C

Trial 13 AB on
BC on Tries 1 2 3
CA off Principle R W
B A C

Trial 14 CA on
AB off Tries 1 2 3
BC on Principle R W
C B A

Trial 15 BC off
CA on Tries 1 2 3
AB on Principle R W
A C B

Trial 16 CB on
AC on Tries 1 2 3
BA off Principle R W
C A B

Trial 17 BA on
CB on Tries 1 2 3
AC off Principle R W
B C A

Trial 18 AB on
BC off Tries 1 2 3
CA on Principle R W
A B C

Trial 19 CB off
AC on Tries 1 2 3
BA on Principle R W
C A B

Trial 20 AB on
BC on Tries 1 2 3
CA off Principle R W
A B C

Total of each try _____ 1 _____ 2 _____ 3

PRINCIPLE TASK
TRANSFER SERIES

BACKGROUND
DISTURBANCE

NAME _____
DATE _____
EXAMINER _____
SCHOOL _____

Trial 1 II
BA on
CB on Tries 1 2 3
AC off
A B C

Trial 2 VI
AB on
BC off Tries 1 2 3
CA on
C B A

Trial 3 III
CA off
AB on Tries 1 2 3
BC on
B C A

Trial 4 IV
AB on
CA off Tries 1 2 3
BC on
A B C

Trial 5 V
AB off
BC on Tries 1 2 3
CA on
B A C

Trial 6 VI
BC on
CA on Tries 1 2 3
AB off
A C B

Trial 7 V
AC off
BA on Tries 1 2 3
CB on
A C B

Trial 8 III
BA on
CB off Tries 1 2 3
AC on
B A C

Trial 9 I
AB off
BC on Tries 1 2 3
CA on
C B A

Trial 10 II
CB off
AC on Tries 1 2 3
BA on
A B C

Trial 11 IV
CB on
BA off Tries 1 2 3
AC on
A C B

Trial 12 I
AC off
BA on Tries 1 2 3
CB on
B C A

Trial 13 III
BC on
CA off Tries 1 2 3
AB on
A B C

Trial 14 V
BA off
CB on Tries 1 2 3
AC on
B C A

Trial 15 I
AC on
BA on Tries 1 2 3
CB off
C A B

Trial 16 VI
CB on
AC on Tries 1 2 3
BA off
A C B

Trial 17 II
CA off
AB on Tries 1 2 3
BC on
C B A

Trial 18 IV
BA on
AC off Tries 1 2 3
CB on
B C A

Trial 19 II
AC on
BA on Tries 1 2 3
CB off
A C B

Trial 20 VI
AB on
BC on Tries 1 2 3
CA off
B C A

Total of each try
_____ 1
_____ 2
_____ 3

APPENDIX F

PAIRED ASSOCIATE LEARNING
(Visual-Auditory)

